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SUPPLY CHAIN MANAGEMENT REVIEW

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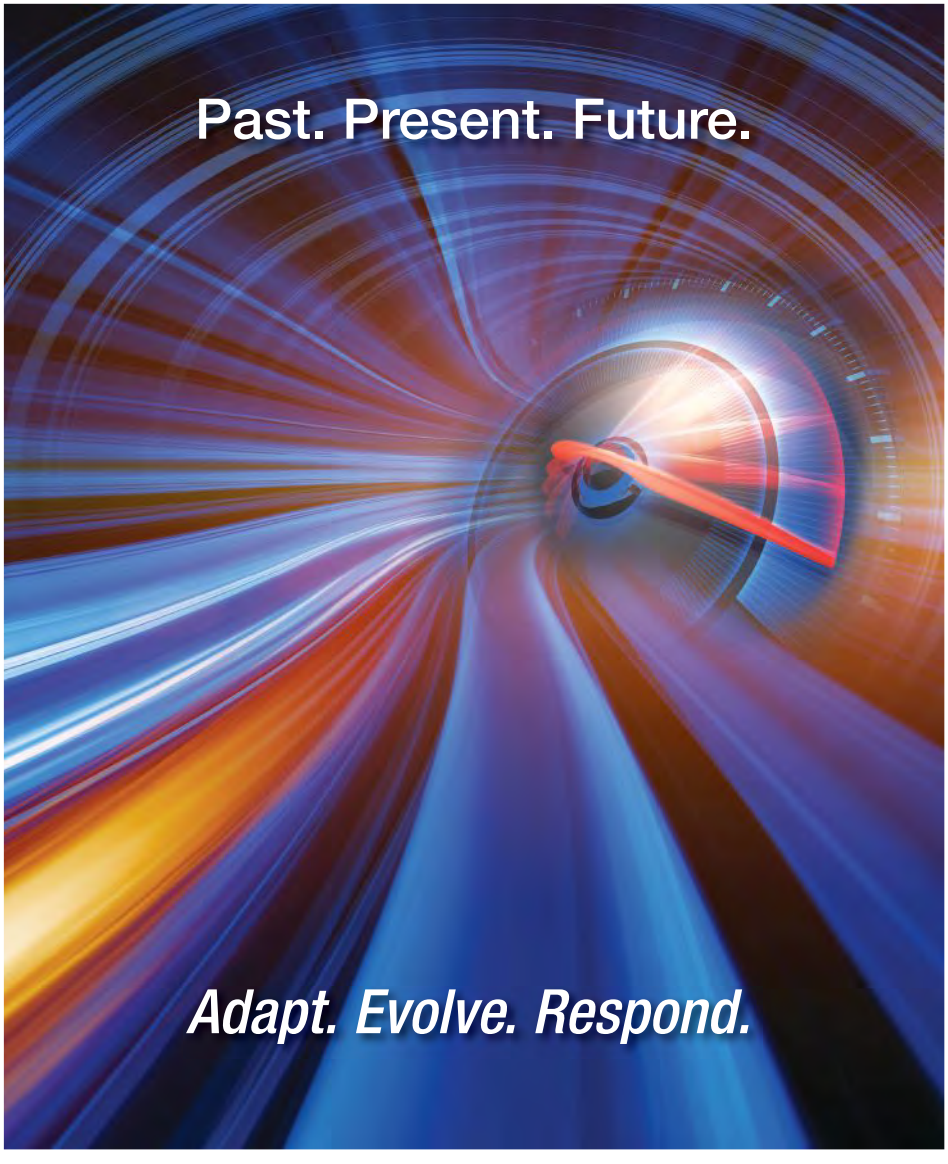

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*Business Continuity Institute and Zurich Insurance Group, 2014 Supply Chain Resilience Survey

Past, present and future

When my wife and I married, reactions came right out of pop music. She was Stevie Wonder ("Isn't She Lovely") and I was Joe Jackson ("Is She Really Going Out With Him?"). More than three decades later, we're still standing.

The same can be said of *Supply Chain Management Review*, which is celebrating its 20th anniversary with this issue. As Frank Quinn, our founding editor, writes in this month's issue, the original reaction to the concept was incredulity: "You want to start a magazine on what?" Yet, *SCMR*'s debut coincided with the emergence of supply chain management as a discipline that could make a difference to a company's bottom line. Here we are, still standing.

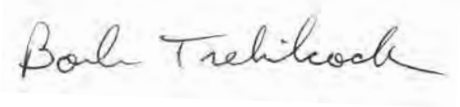
Twenty years after the premier issue, our goal remains the same: To present thought leadership around best practices in supply chain fundamentals, publish case study examples of what leading companies are doing in their supply chains and keep our finger on the pulse of emerging trends and technologies that will shape the future. While Frank's essay looks to the past and brings us to the present, we also have essays from four experienced supply chain professionals looking to the future of supply chain management.

We're also pleased to publish Bob Lieb's annual report on the 3PL industry. For more than 25 years, Lieb, a professor at Northeastern University, has surveyed the leading North American 3PLs to take the temperature of the industry and uncover the trends that are affecting the business. In addition to this article, we'll be publishing more of Lieb's findings on scmr.com. It's a must read for any 3PL or practitioner using a 3PL.

Bob Trebilcock, Editorial Director
btrebilcock@peerlessmedia.com

We round out the issue with an article on how to achieve supply chain agility, and a piece on a framework to align your business and supply chain strategies. I think the two are related: Too often business and supply chain strategies are designed independently of one another; that leads to supply chains that are out of synch with the needs of the customer and are slow to respond to new demands. Meanwhile, supply chains that are designed with the business strategy and customer in mind are quick to adapt and react. Last, but not least, Robert Trent, one of our long-standing contributors, identifies the five trends that are shaping supply chains today, based on conversations with executives and his work with a Fortune 50 company.

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



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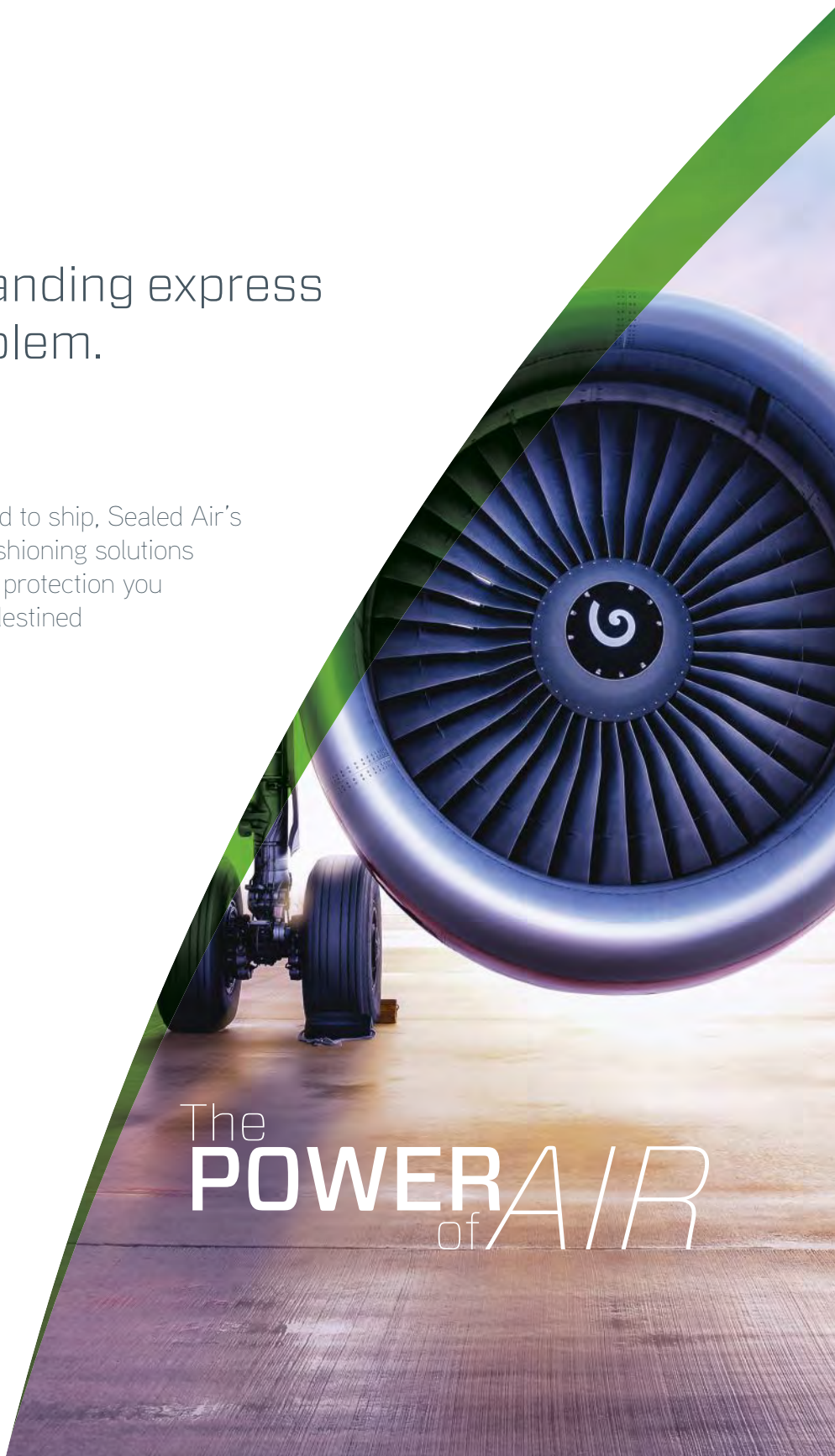

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Executing the S&OP plan

When S&OP goals are aligned to the business strategy, strategically-based execution happens every day. But, it's not as easy as it sounds.

Just as there are two sides to every coin, there are two sides to sales & operations planning. On the one side are the sales plans developed by the sales and marketing side of the business. On the other is the operational side of the business that has the responsibility of executing the operations plan: Manufacturing, transporting and distributing the goods at the heart of the plan. Executing on the plan sounds simple. Yet, synchronizing execution activities so that they also meet the performance goals of the S&OP plan is not as easy as it sounds.

In a past column,* I argued that the main purpose for synchronizing short-term operational plans with the S&OP is to help align daily operations—such as those that take place on plant floors and within distribution centers—with S&OP plans developed to meet performance goals. This helps operations managers to plan in accordance with financial and various other performance objectives. In addition, if S&OP plans are also aligned with strategic planning goals and objectives, then daily operations are more closely aligned with corporate strategy.

This alignment is important when operations managers need to execute in accordance with a supply chain strategy developed to be competitive, as I defined it in "Competitive Supply Chains**." To be competitive, operations managers need to support and enhance the business strategy, and be among the role players that help win business in the short, medium- and long-run. However, how close can "real-time" execution match the short-term operational plans put in place, anyway? As we're reminded by Robert Burns line about the "best laid plans of mice and men" and the Yiddish proverb that "man plans and God laughs," execution can get close, but planning accuracy is rarely—if ever—a 100% match.

That said, if the plans could be 100% accurate, would your execution systems enable the S&OP goals and objectives? I still think not due to the difference between planning and execution systems. Most supply-side execution systems focus on decision making to optimize costs and inventories, but not customer demand. Thus, they are typically driven by unit-based volume data, not by moneyed data, such as revenue and operating margins. For example, a revenue-oriented order management system would fill higher operating-margin and low-volume customer orders before it fills lower-margin, high-volume orders. Yet most systems favor filling the latter first because they involve more labor hours.

Planning vs. execution

I first encountered the concept of the difference between planning and execution when I joined AMR Research (now part of Gartner, Inc.) in late 1997—in the heyday of supply chain management. At AMR, we followed 100 or so software companies offering SCM functionality.

To keep track of the market, we grossly divided functionality into two categories, supply chain planning and supply chain execution. The bifurcation depended on the type of planning that the software was designed to support: including strategic, tactical and operational planning. It also depended on the how software functionality enabled users to manage various lengths of "planning horizons," with corresponding "time buckets" such as days, weeks, months or years.

Execution systems modifications

By their nature, S&OP meetings need to focus on aggregated plans and forecasts. Thus, the supply plans generated by an S&OP process are too aggregated to directly drive operational plans. In addition, operations managers deal with shorter planning horizons and time buckets that are rooted in

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terms of hours, days and weeks rather than in months, fiscal quarters and years, as is common in S&OP planning. Finally, supply-side managers largely make decisions based on unit-volumes; rarely, if ever, are their decisions based on financial goals such as profitability.

To help synchronize S&OP plans with shorter-term operational plans, the use of a Forecasting/Planning Hierarchy is a key enabler of an S&OP process. It is used to foster cross-functional collaboration, consensus and synchronization. While S&OP plans typically deal with more aggregated levels of the hierarchy, lower, more-detailed levels are most useful for operational managers. Thus, I have advocated in the past that S&OP planners and forecasters need to develop the lower portions of the hierarchy and provide detailed plans and forecasts so that operational managers can align operational plans with the S&OP plans.

While this helps synchronize operational and S&OP plans, it does not ensure that execution follows the S&OP plans even when they are accurate. The potential misalignments are often the result of execution practices, as well as standalone execution systems that are disconnected from planning systems. Thus, adjustments might need to be done to reduce the gaps between a plan and its realized execution. Some illustrations are described below.

Manufacturing and procurement. Manufacturing managers use systems to schedule production lines and to develop Master Production Schedules (MPSs) that are used as inputs to Materials Requirements Planning (MRP) systems. The systems consider goods on a unit-volume basis without regard to revenue, costs, margin or inventory valuations. Yet S&OP plans target a balance among these. Because the systems don't directly consider these, it may be necessary to adjust purchase orders (POs). For example, in order to increase cash flows or meet revenue/margin requirements, some POs may need to be expedited to replenish materials and components that go into making higher-revenue/margin products.

Inventory management and Distribution Requirements Planning (DRP). DRP systems use demand forecasts to develop future finished goods inventory replenishment requirements. They estimate goods flow (in unit-volumes) in a supply network. Because these systems don't consider capacities, the flows that are capacity-limited will need to be adjusted on an ad hoc basis. Also inventory management systems are usually standalone from planning, and produce their own demand forecasts. However, the forecasts—including errors—used to determine safety stock levels in these systems are not necessarily consistent, nor are they checked for consistency with those used to develop S&OP plans. Therefore, some adjustments might need to be made to the standalone systems to more closely align with the S&OP forecasts.

Order management. Most order management systems prioritize order fulfillment on a First-In-First-Out (FIFO) order basis. However, an S&OP plan might have been developed to maximize revenues and cash flows. This plan might have inherently assumed that high revenue and operating-margin customer orders would be fulfilled as soon as possible, in order to meet the financial goals. Customer order priority rules would need to be applied to ensure orders are processed in a sequence consistent with the S&OP goals.

Warehouse and labor management. These systems assign personnel to tasks based on the unit-volume of work, and not on the monetary value of the goods handled. Thus receiving dock workers routinely receive goods and put them into storage as soon as they come in on a FIFO basis. However, similar to the above illustration, an S&OP plan might have been developed to maximize revenues and cash flows. The plan might have inherently assumed that high revenue and operating-margin goods would be put into storage first, or even cross-docked directly to packing and shipping work centers, in order to put them in the hands of customers as soon as possible. In addition, warehouse and labor management systems often make overtime decisions based on the labor-hours needed to pick, pack and ship orders, in contrast to monetary factors. However, overtime decisions to support this type of S&OP plan would likely justify overtime for higher-value orders, and not necessarily for lower-value orders.

Transportation and international trade logistics management. Similar to the above, transportation systems would need ad hoc rules applied to align execution more tightly with an S&OP plan focused on revenues and cash flows. Transportation scheduling systems create loads and routes, and then select transport modes for orders to be shipped based on cost optimization. However, expensive and faster delivery modes might be justified for higher-revenue and margin orders. These orders would need to be consolidated on modal routes, while lower revenue and margin orders might be better consolidated and shipped together using inexpensive and slower transport ones.

In summary, tighter synchronization of execution with planning involves more than just synchronizing the operational plan with the S&OP plan. Making sure that execution follows the operational plan (as closely as possible) is not so simple. More often than not, the goals embodied in the S&OP plan cannot be enabled without modifying executional practices and systems, to ensure execution most closely follows the S&OP plans. In turn, if the S&OP goals are aligned to business strategy, then strategically-based execution happens every day.

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* *"Execution managers need the S&OP plans, too," Insights, May/June 2016,* SCMR

** *"Competitive Supply Chains," December 2016,* SCMR

The real keys to innovation: Knowledge and creativity

Technology promises to revolutionize the way supply chains are managed. However, in-depth knowledge and creative problem solving can enable significant supply chain innovations without the need for new technology.

By Roberto Perez-Franco

Roberto Perez-Franco is a research affiliate with the MIT Center for Transportation & Logistics. He can be reached at roberto@mit.edu.

At a time when promising new technologies (Big Data, Internet of Things, Blockchain, to name a few) promise to revolutionize the way supply chains are managed, it is tempting to conflate the idea of supply chain innovation with new technology. However, to assume that cutting-edge technology is necessary for innovation would be a mistake; revolutionary innovation is possible without revolutionary technology. In-depth knowledge and creative problem solving can enable significant supply chain innovations without the need for new technology.

Consider the case of EuroPartners, a provider of international logistics services based in Mexico and serving hundreds of customers throughout Latin America. One of their offerings is the fast delivery of spare parts for specialized machinery. When one of EuroPartners' customers orders a spare part to repair a broken machine, one thing is certain: The customer needs the part without delay. Every day a specialized machine is out of service, hundreds or even thousands of dollars are lost by the customer. Speed, therefore, is of the essence, and EuroPartners' promise is to deliver the spare parts within 36 hours of the time an order is placed.

It is relatively straightforward to fulfill this promise when the customer is located close to an international airport with frequent direct flights from Mexico City. Using an airport-to-airport priority cargo service, called Next Flight Out (NFO), EuroPartners can easily fulfill an order overnight. For example, an order placed before noon on a Monday by a customer located in Bogotá would be delivered at Mexico City's international airport that evening, flown from Mexico to Colombia overnight, clear Customs in the morning and be ready to be picked up by the customer at Bogotá's international airport shortly after noon on Tuesday.

The challenge

Fast delivery becomes a challenge for EuroPartners when the customer is located in cities without frequent direct flights from Mexico City. In theory, using the airport-to-airport priority cargo service to serve these customers is still an option; in practice because the parcel needs to be moved from one plane in the international terminal to another plane in the domestic terminal of the airport, the total time from origin to destination increases by one or two days, which is not acceptable given EuroPartners' "under 36 hours" promise. For a customer located in Cali, an order placed before noon on a Monday—if it were delivered using the airport-to-airport priority cargo service—wouldn't be available for pickup until after noon on Wednesday at the earliest.

Using a courier service for the domestic leg of the trip is not an attractive option because domestic courier services in Latin America typically use ground transportation. In an expansive and mountainous country like Colombia, for the parcel to go from the airport to the courier's facility, then in a truck over hundreds of miles to a smaller distribution center in Cali and then in a smaller vehicle on a distribution route to the customer, usually takes two or three more days.

The only alternative left to EuroPartners to fulfill the 36 hours promise is to send an employee on a round trip flight from Mexico City to Cali. This requires the employee to go to the airport with the parcel (which usually weighs less than 30 lbs.) and fly to Bogotá, clear Customs, then take a domestic flight from Bogotá to Cali and finally a cab from the airport to the customer's location to hand deliver the parcel well within the 36-hour window. The employee would then fly back from Cali to Bogotá, sleep in a hotel near the airport and fly back home to Mexico the next day. This special service is known as On Board Courier (OBC) and is much more expensive than NFO, due to the cost of the employee's time plus the round-trip tickets and hotel expenses. OBC is an option used when customers cannot afford to wait two extra days and are willing to pay a premium to help cover the extra expense.

The innovation

This is where EuroPartners managed to introduce a clever innovation that revolutionized its deliveries to smaller cities throughout Latin America, with the crucial help of a young entrepreneur, David Hidalgo, at the time a student of MIT's GCLOG Program and currently a Ph.D. student at MIT SCALE's Zaragoza Logistics Center. From his experience as a researcher at MIT SCALE's Center for Latin America Logistics Innovation, Hidalgo developed an in-depth knowledge of local logistics in Colombia, along with a local network of trusted friends and young collaborators who, like him, were looking to take on a challenge. Working together, with some very creative problem solving, Hidalgo and EuroPartners came up with a solution that retained the speed of OBC (the "nuclear option") at about half the cost.

The new solution is called Domestic Hand Carrier (DHC), and it works as follows. EuroPartners receives an order for a spare part to be delivered fast to a customer in a city without frequent direct flights from Mexico City. For the sake of the example, let's say the customer is in Cali. EuroPartners will send the parcel using the NFO service from Mexico City to Bogota. At the same time, it will contact Hidalgo via email or phone with all of the information he needs to arrange the domestic leg of the trip. He will reach out to several on-call members of his logistics network and identify one that is ready to serve as domestic hand carrier to take the parcel from Bogota to Cali. The hand carrier picks up the parcel as soon as it has cleared customs in Bogota's airport, and proceeds to board the next available domestic flight from Bogotá to Cali. After a short domestic flight, the hand carrier will take a cab directly to the customer's facility and hand deliver the parcel well within the 36-hour window. Then, the hand carrier flies back to Bogotá and is paid for his service.

Even though they both take approximately the same time from origin to destination, the innovative DHC solution costs 40% to 45% less than the OBC option because domestic flights inside Colombia are cheaper than international flights and there are almost no hotel expenses. Additionally, Hidalgo's local contacts are familiar with the cities where the deliveries are made and stay in constant contact via cellphone with both Hidalgo and the customer to provide updates about the parcel's location and its estimated time of arrival. This information contributes to the customer's peace of mind and improves their satisfaction with the service.

The beauty of the DHC solution lies in the fact that it relied solely on Hidalgo's creativity, in-depth local knowledge of Colombian logistics, a network of friends and partners and on EuroPartners' willingness to try original and new solutions to old problems.

The lesson

The beauty of the DHC solution lies in the fact that it relied solely on Hidalgo's creativity, in-depth local knowledge of Colombian logistics, a network of friends and partners and on EuroPartners' willingness to apply new and original solutions to old problems. This innovative solution required no new technology whatsoever: a few emails and phone calls, and knowing the right people for the job is all it took. And yet, it has revolutionized the way EuroPartners distributes throughout Latin America, by allowing them to extend their 36-hour window promise to many more cities—not just capitals. Currently, their average delivery time is around 25 hours.

This is a reminder of what lies at the heart of innovation: the ability to see both the forest and the trees, of taking what already exists and using it as a foundation to build what can be, the willingness to contemplate an old problem with fresh eyes, and to connect seemingly unrelated and contradicting elements into a coherent new solution.

So, the next time you hear about some development regarding one of the many new buzzwords that promises to revolutionize your supply chain, remember that supply chain innovation can simply be about in-depth knowledge and creative thinking.

Procurement's diversity and threat equation

Procurement professionals need to protect their businesses from the growing legal risk of third party corruption. Meanwhile, virtually all "diversity" suppliers meet or exceed expectations

Revelations in a recent survey that only half of multinational businesses carried out basic corruption checks on third parties last year prompted a stern rebuke from David Noble, group CEO of the Chartered Institute of Procurement and Supply (CIPS).

In a new report, he notes that new laws continue to make companies increasingly liable for third parties' acts of corruption or bribery, thereby placing added pressure on businesses to conduct the right due diligence on their partners.

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

However, while low levels of investigation in large businesses are disappointing, they may not be surprising, says Noble.

"A licensing approach to procurement and supply will begin to ensure the right structures are in place to enable this to happen, with the attendant law of consequence that the license will be lost if malpractice is discovered," he advises.

The survey of 604 chief compliance officers and heads of legal, conducted on behalf of the law firm Hogan Lovells found only half of respondents (53%) said they conducted desktop due diligence on third parties.

Nearly half (44%) did not conduct face-to-face interviews or send questionnaires to third parties, and the same percentage did not have audit clauses in all their contracts. Well over a third of respondents (42%) said they did not have a complete record of all their third party suppliers.

"Fixers" in the market

Considering that many of the companies interviewed had a potential risk of third party corruption, Crispin Rapinet, global head of investigations, white collar and fraud, at Hogan Lovells, says it was surprising so few companies did this due diligence.

"It means 45%, let's say, are going to have a problem if anything goes wrong. Which, given the risks of things going wrong in terms of size of the penalties, we find quite surprising," he observes.

International anti-corruption laws have become increasingly tough, adds Rapinet, with more countries developing and enforcing their own regulations. The main issue with third parties was knowing exactly who the players are.

"In the procurement and supply chain arena you would probably still have fixers in some markets," he says.

Due diligence needs to be "proportional" to the risk, and the best defense companies can take against falling foul of third party corruption law is to keep proper records of what investigation has been done and why, Rapinet says.

"If you have a problem, but you can produce a file that shows that you did a risk assessment—that you took a view that this person, or this agency, was relatively low risk for these reasons and on the basis of that risk assessment you did the following due diligence—you would get a sympathetic hearing from the regulators," he says.

Diversification advantage

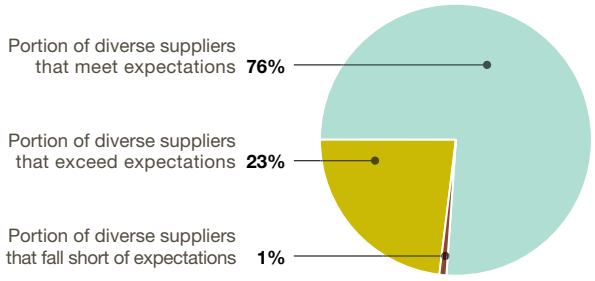
New research from The Hackett Group, Inc. finds that virtually all diversity suppliers

"meet or exceed expectations," and top corporate performers in supplier diversity experience no loss in efficiency.

While most supplier diversity programs have a domestic focus, The Hackett Group's study found that more than 40% of all global companies with a U.S. supplier diversity program plan to expand worldwide within the next two to three years. The Hackett Group recommends that companies manage U.S. and global programs as a single initiative, where appropriate. Partnering with corporate diversity groups, which manage workforce diversity, is also highly advisable, as is working with third parties that can help companies connect with diverse suppliers.

FIGURE 1

76% of all diverse suppliers meet buyers' expectations; another 23% exceed them



Source: Supplier Diversity Performance Study, The Hackett Group, 2016

In addition, they see improved quality and often extract other benefits, including increased market share and access to new revenue opportunities. The research challenges the attitude of many business leaders, who worry that dedicating resources to supplier diversity will divert attention from other strategic activities.

To truly unlock the full potential benefits of supplier diversity efforts, The Hackett Group recommends that companies consider expanding beyond traditional goals such as complying with regulations.

Top performers in supplier diversity recognize the value of objectives such as the ability to gain access to new markets and improve supplier partnerships. In addition, companies are advised to look beyond basic measures, such as the percentage of spend with diverse suppliers, and calculate the true value of supplier diversity by using more sophisticated performance metrics such as satisfaction levels and other secondary metrics that are aligned to long- and short-term plans and objectives.

Developing communities

"Supplier diversity is evolving from a check-the-box corporate social responsibility requirement to a strategic enabler providing access to new and innovative products and increased market share in new and developing communities," notes The Hackett Group research director Laura Gibbons. "Top-performing organizations are taking advantage of this opportunity, and applying the tenets of social diversity to new areas such as supplier partnering, reputation management and global expansion with exceptional results."

"There are certainly challenges that need to be overcome," cautions Gibbons. "It can be difficult to obtain the necessary support to invest in supplier diversity programs. Business leaders often worry that dedicating resources to this will impact procurement savings or even quality."

"Supplier diversity is evolving from a check-the-box corporate social responsibility requirement to a strategic enabler providing access to new and innovative products and increased market share in new and developing communities."

But this research clearly shows that this is not true, adds Gibbons, who maintains that top performers are not seeing losses in efficiency, and quality often improves.

"Overall, the risks to focusing on supplier diversity are quite low, and the potential upside is significant," she says. "In fact, up to 10% of sales come with supplier diversity requirements, suggesting that the lack of such a program can even result in lost revenue."

"Trust, but verify"—a translation of a Russian proverb, which was also used by President Ronald Reagan in the context of nuclear disarmament—might be turned around in this context, say analysts. When it comes to hiring a diverse (but risky supplier): "verify, but trust."

Supply Chain Management: Past, Present and Future

On our 20th anniversary, *SCMR* asked founding editor Frank Quinn and four industry experts to weigh in on the future of supply chain management.

1997-2017

BY FRANCIS J. QUINN

SCMR's first 20 years

"You want to start a magazine on what?"

That was the incredulous question we heard more than 20 years ago when *Supply Chain Management Review* was first proposed.

But a core of true believers in our publishing company were convinced that this emerging discipline called supply chain management would soon become a dominant force in business success. We argued that the publication that established itself as the "go-to" supply chain information resource—for the practitioners, service providers and educators who would make up that community—would enjoy a readership advantage for years to come.

Happily, we convinced our management of the importance of supply chain management and of the need to fill an emerging information void. We launched a prototype issue in 1996 that was warmly welcomed by focus groups and in industry surveys. We soon got the green light to begin regular publication and in the spring of 1997 launched the first edition of *Supply Chain Management Review*. It's been going strong—no, make that getting better—ever since.

The late 1990s was a period of transition in our world. Traffic and transportation management had given way to the concept of physical distribution management, which before long would be called logistics management. By the end of the '90s, the term supply chain management began popping up in academic papers and at industry events. SCM would be broadly defined as all of those activities involved in moving goods from the raw materials stage though to the end user. The momentum toward integrated supply chain management was building—although pockets of doubt still lingered.

A prescient column in our very first issue by legendary educator Bernard J. (Bud) LaLonde of The Ohio State University asked

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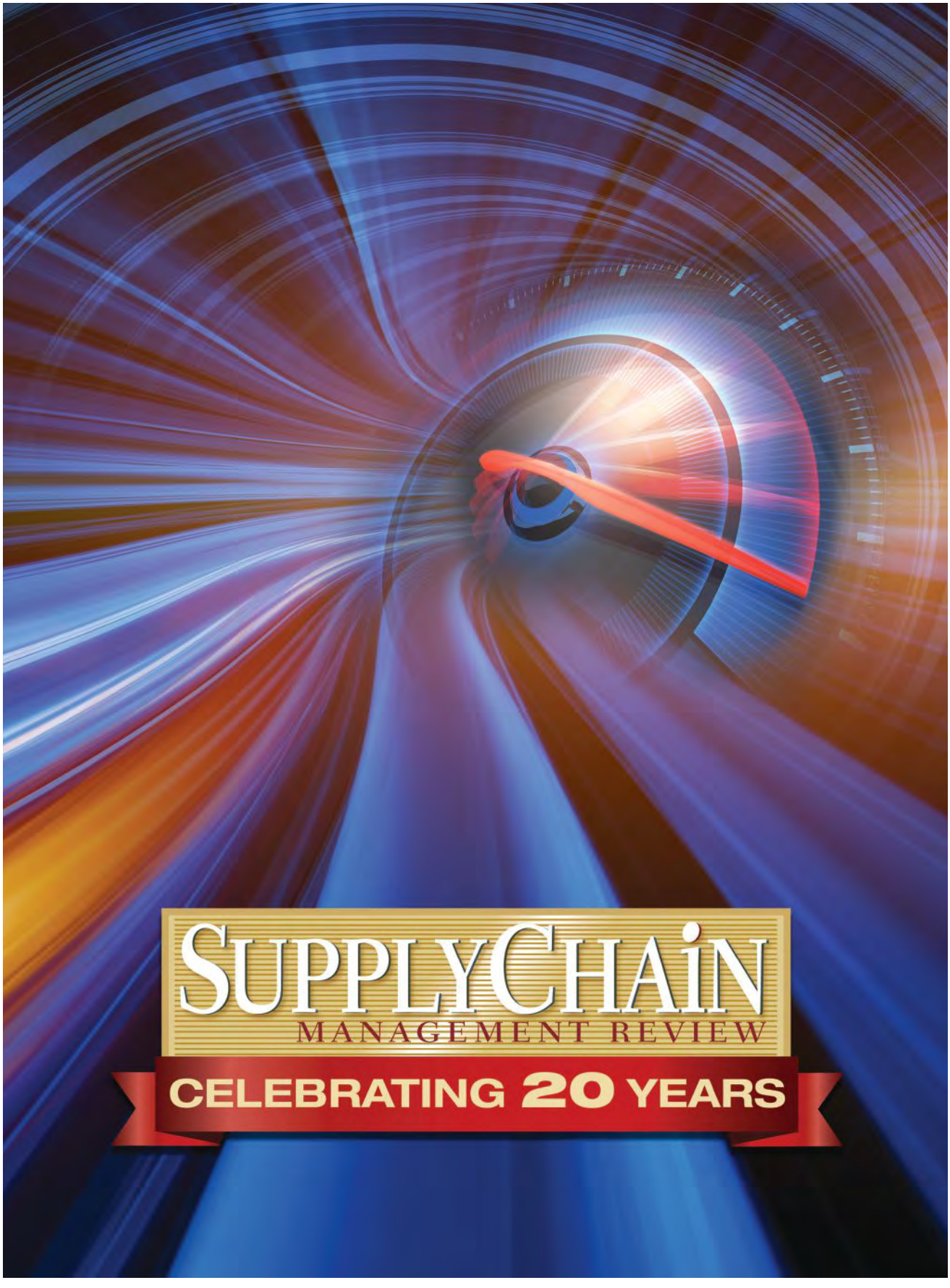
Editorial advisor Francis J. Quinn was the founding editor of Supply Chain Management Review.


SUPPLY CHAIN
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CELEBRATING 20 YEARS

whether supply chain management was a "myth or reality?" Bud argued convincingly that it was the latter—and that companies not embracing this new reality put at risk the value they provided to their customers.

A look at some of the feature articles in that first issue of *SCMR* show that many of the challenges supply chain professionals faced 20 years ago remain front and center today. Here are a few examples.

Supply Chain Management Review never would have gotten off the ground, let alone lasted 20-plus years, without you, our readers.

- The article: "How to Design an Optimum Supply Chain" written by management consultant Paul Bender speaks to a challenge that has only intensified as companies become more global and complex.
- As is the case today, readers 20 years ago were eager for insights and information on how the best companies run their supply chains. So I'm convinced that Professor Don Bowersox's piece "Lessons Learned from the Supply Chain Leaders" would be as timely today as it was in our inaugural issue.
- A seminal article on the "Seven Principles of SCM" by Andersen Consulting (now Accenture) remains in high demand to this day. In fact, this has been the single most reprinted article in the history of our publication.

Now this is not to say that the art and science of supply chain management has remained static since 1997—far from it. New technologies in forecasting and demand planning, shipment visibility, automation and fulfillment have brought us to unprecedented levels of efficiency. Organizationally, leading companies have broken down the siloes inhibiting productivity, replacing them with integrated processes that enhance customer service and support profitability. In short, supply chain management is now widely regarded as a foundational element in overall business success.

On the education front, the progress has been similarly impressive. Twenty years ago, courses with "supply chain" in the title were just beginning to appear in business school curricula. Today, many excellent universities offer degrees in supply chain management ranging from certificates and bachelor's degrees up to doctorates. Notably, many of these programs are offered online as well as in traditional classroom settings. For practitioners—and for students contemplating potential career paths—supply chain education pays off. Educators at the major universities in our field will tell you that a supply chain concentration is among the most sought-after on their campuses. More importantly, the job market for young people with a degree in this field is robust and growing.

From a personal standpoint, I wish to acknowledge the educators that have helped usher in the supply chain era. They have advocated long and hard for supply chain management to "have a seat" at the education table along with finance, marketing, engineering and other more traditional disciplines. The great majority of supply chain educators that I have met over the years have a clear understanding of business realities and the related supply chain component—the term "ivory tower" does not apply here. And not insignificantly, these individuals were among the first and most enthusiastic supporters of *SCMR*. For that, I am truly grateful.

We've also seen the evolution of our professional associations over the past 20 years. The names have changed to reflect the new business reality (the Council of Logistics Management became the Council of Supply Chain Management Professionals, for instance, while the National Association of Purchasing Managers is now the Institute for Supply Chain Management), as has the scope of their offerings to members. These organizations provide a wonderful opportunity to network with fellow professionals, as they always have. They're still doing this today—plus a lot more. Targeted online education programs, certifications, access to research and peer interaction has added a valuable dimension to membership. One of my soapbox platforms as editor of *SCMR* was encouraging readers to become *active* in organizations like CSCMP, ISM, APICS and the NITLeague. Membership has always been a social, educational and thoroughly enjoyable experience—and a tremendous complement to a supply chain career.

One more thought before I end: *Supply Chain Management Review* never would have gotten off the ground, let alone lasted 20-plus years, without you, our readers. I'm going to be presumptuous here and speak for myself and for Bob Trebilcock, my successor at the *SCMR* editorial helm: We are forever in your debt.

A new score for supply chains

BY CHRIS CAPLICE

Additive manufacturing, autonomous vehicles, blockchain technology, the Internet of Things and multi-channel retailing are some of the innovations that are driving tremendous change in supply chain management today. Yet the innovative trend that is of most interest to me is already several decades old—the growing importance of service over products.

Although this trend is not new, it is more relevant to the future of supply chain management than ever, and its impact is gaining momentum. I believe that the value of services has finally eclipsed the value of the underlying products, and that this portends tremendous changes to supply chains going forward.

Back to the future

One way to understand what the future might hold for supply chains is to review how a different industry navigated a sea change in the past. Academics often look for these historical canaries in the coal mine.

One of my favorite industries to follow is the recorded music industry because it has an exceptionally fast clockspeed. That is a term coined by MIT professor Charlie Fine to identify industries with very fast reaction cycle times to change. Its performance over the last 40 years reveals some striking insights into how the supply chain industry could change in the future.

In the early 1970s, the pre-recorded music industry was flying high. There was significant consolidation amongst the manufacturers—the major labels—and the vinyl long playing (LP) record had been a relatively stable format for over a decade. That all began to change in the mid-to-late 1970s as the LP gave way to 8-tracks, cassette tapes and finally, nearly 20 years later, to compact discs (CDs). Yet, regardless of the format, total sales of physical product grew dramatically. In 1976, just fewer than 400 million units of pre-recorded music (mainly vinyl records but also cassettes and 8-tracks) were sold in the United States. By 2000, the number of units of pre-recorded music shipped exceeded 1 billion—the vast majority of which was CDs.

Each new format change not only increased usability, but also represented a dramatic densification. In 1973, the weight of the product required to provide one hour of music was just over 8 ounces, or half a pound. By 2000, this had dropped to just over 2.5 ounces, a four-fold density increase from seven minutes to over 24 minutes of music per ounce. During that period, the number of units shipped doubled, and the amount of hours of music sold increased by fivefold even though the weight shipped only increased by a third. This value densification (minutes of music per pound of product) led to a 65% reduction in the ton-miles required to distribute the product over the 30-year period. Interestingly, other industries did not invest heavily in the densification of their products (reducing package size, removing water and miniaturizing components) to achieve the logistics benefits that the music industry enjoyed until decades later.

Step change

That, of course, was not the end of the story. In the mid-2000s, the music industry was hit with digitization. Rather than buy CDs, music lovers downloaded their favorite songs and albums. By 2011, the total revenue from digital downloads surpassed that from physical products; by 2015, the number of physical units sold per year had shrunk from over 1 billion to just over 100 million.

Confronted with a shifting marketplace, the major labels fell prey to the innovators dilemma and are now a classic cautionary tale of what not to do under massive technological change. Rather than embrace digitization, they fought change through legal actions and other obstructionist means—and lost. In the end, outside players like Apple's iTunes store drove the innovations that transformed the way consumers buy and listen to recorded music today.

Yet, the transformation is not over. The new innovators are providers of streaming services, where the user rents music from a service such as Spotify, Pandora or AppleMusic rather than buy specific songs or albums. The service is either free to the user (with revenue coming from advertising sales) or requires a subscription fee. In 2015, total revenue from streaming outpaced the revenue from either physical sales or digital downloads.

This reflects a change that is unlike densification and digitization, where the innovation was in the production or manufacturing of the "product." This time, the innovation is in the way music is consumed. As a life-long audiophile, I can attest to this. My collection of thousands of LPs, 8-tracks, cassettes and CDs is tucked away in an attic.

The idea of capturing the "voice of the machine" to make predictive analytics is starting to happen today.

While I downloaded several mortgage payments worth of songs from iTunes between 2008 and 2014, I now stream my music. Essentially, for me, as with a growing number of consumers, recorded music has changed from being a product to buy to a service to rent.

The rise in streaming is also changing the way that musicians release their music. Rather than large-scale launches of an album every two years, musicians stay in the forefront of the listener's attention by releasing individual songs or small batches continuously. So, in a sense, this change in consumption is changing the production or at least the timing of release.

Far-reaching implications

Many industries today are facing this transformational challenge of shifting from making a product to providing a service. The auto industry is a strong example. A larger segment of consumers is becoming more interested in the idea of *mobility* than car *ownership*. The rise of pooled car sharing services (Zipcar etc.) and non-traditional taxi services (Uber, Lyft) is having a dramatic impact on the demand for cars. It has been estimated that every car introduced into a car pool replaces five vehicles. The same general trend is occurring in other large asset industries, such as aeronautics, where Lockheed Martin famously shifted its sales from engines to hours of uptime for the military.

Once we recognize this shift from product to service, we can start thinking of the implications to supply chains, which I believe will be dramatic. The most obvious is a reduction in the number of physical units produced. With fewer units, the utilization of each unit will have to increase in order to handle the underlying demand for the core service being provided. This could drive higher quality or more resilient products that can sustain increased use for extended periods of time. That leads to easier cost justification for investments in more sensors to track how these items perform as well as the creation of real-time simulations and monitoring of these products. This is sometimes called digital twinning and is already becoming widespread in locomotive engines. The idea of capturing the "voice of the machine" to make predictive analytics is starting to happen today.

Of course, these are just conjectures. It could be that some of these industries become totally fragmented and operate as a marketplace of independent players. Just as most supply chains have embraced densification and been faced with digitalization challenges as has the music industry, so will they encounter the transformational shift from products to services. This will require each company to reassess and reevaluate exactly what their firm provides to consumers—not the product, but the underlying need that their products can satisfy.

I am excited to see how this trend toward service-centered products spreads and grows. It will fundamentally change supply chains—exactly how is anyone's guess.

Chris Caplice is the executive director of the MIT Center for Transportation & Logistics.

Interesting times ahead for SCM

BY SEAN MONAHAN

In the ever-evolving world of supply chain management, the expression "may you live in interesting times" is viewed by many as a curse. For me, I look forward with anticipation to a supply chain that thrives on a future with heightened expectations, new capabilities, unavoidable challenges and yes, even unknowns.

Heightened expectations are the new normal

The importance and stature of supply chain management within organizations has risen dramatically over the past decade—and we can expect that trend to continue. Gone

are the days of supply chain as a necessary evil with its primary mission being to not fail. Certainly, not failing is still an expectation, and as the steward of most of the costs and assets of many organizations, continuous productivity improvement will remain table stakes. But increasingly, the discussion focuses on how the supply chain can be leveraged as a competitive differentiator providing enhanced capabilities to our customers such as personalized products and "instantaneous" delivery and fulfillment. The expectation will be that the supply chain contributes directly to the top line on par with more traditional commercial functions. As such, supply chain leaders must play a larger role in the C-suite and in boardrooms. On a national scale, countries are leveraging supply chains as a primary vehicle to drive economic development. Government leaders are making industrial policy a centerpiece of their agendas, including: "Make in India;" Germany's Industrie 4.0; Made in China 2025; Ethiopia's Industrial Development Strategic Plan; and the Trump Administration's Manufacturing Council.

The impact of technology on jobs has been a challenge since the creation of the first machine, but the historical impact has generally been additive with new job classifications and employment exceeding prior levels.

New capabilities

We are at the beginning of the 4th Industrial Revolution driven by emerging technologies. While much of the discussion focuses on the "Fab Five" technologies—Internet of Things (IoT), Artificial Intelligence, Augmented/Virtual Reality, Robotics and 3D Printing—through recent work in collaboration with the World Economic Forum, we have identified over 50 technological advances that will shape the future of supply chains. Individually, and as they converge, these technologies will transform how we design (e.g., unconstrained), how we manufacture (e.g., batch size of one), where we produce (e.g., localized to consumption), how we skill, how we partner and how we sell. These technologies will support new levels of productivity, new levels of sustainability and new business models that help supply chain managers deliver on the heightened expectations noted above.

The challenge of sustained employment with transformative technology

Just as power brings responsibility, capabilities and opportunities are frequently accompanied by challenges. While the technologies of the 4th IR will bring new capabilities, much of the popular discussion focuses on how these technologies will result in the loss of jobs. Or, as the Guardian opined this past January: "Robots will destroy our jobs—and we're not ready for it." The impact of technology on jobs has been a challenge since the creation of the first machine, but the historical impact has generally been additive with new job classifications and employment exceeding prior levels. However, while past industrial revolutions have been inter-generational, allowing the next generation to build the skills to prosper as new technology proliferates, current and future revolutions will be intra-generational requiring workers—blue- and white-collar alike—to retool and retrain multiple times over the course of their careers. How can public and private organizations work to support workers during these transitions to ensure that displaced workers are enabled to bridge the transition, and that employers have access to the appropriately skilled labor pool required to take advantage of these new technologies?

Unknowns create uncertainty as well as opportunity

While the timing, scope and scale of the expectations, capabilities and challenges outlined above cannot be predicted with any precision, I am confident that the trajectory is clear. However, there are a variety of other factors that are much less clear. Chief among these "known unknowns" is the nature of global interaction. As my colleague Paul Laudicina recently noted: "After a 25-year period of supercharged globalization, we have now arrived at an inflection point at which the entire future of the dominant post-war paradigm is in jeopardy." For at least the near term, we can readily anticipate a step back from globalization and multilateral trade agreements, and we can already see the impact rippling through supply chains as decisions to offshore, onshore and select suppliers are paused or reconsidered. How this "inflection point" plays out will shape supply chains for decades to come. And, certainly there are "unknown unknowns" we cannot even begin to speculate on.

As I look to the future, I am reminded of the questions I addressed with clients in 1997: Could changes over the past two decades provide any guidance on what lies ahead? What I find is familiar. Many of today's questions have not changed in the last 20 years: post-merger supply chain integration, working capital improvement, differentiated customer service strategy, plant productivity (Lean, 6 sigma), complexity management, material sourcing, organization design and talent development, distribution network strategy, new market entry, outsourcing and off-shoring. However, what have changed are the expectations of performance, the tools available and the clockspeed of change.

What excites me about supply chain management in the years ahead? The expectation that supply chain management can be leveraged as a competitive differentiator and fully deserves an important role in company strategy. New and exciting capabilities will enable us to create more value for our customers, shareholders and communities. Challenges and unknowns will arise to stimulate our thinking and creativity, inspiring supply chain management to deliver robust, agile solutions. And there is comfort in knowing that in the interesting times to come, there are foundational tenets and issues that we'll continue to pursue in search of better outcomes.

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The new rules of LIVING supply chains

BY TOM LINTON AND ROBERT HANDFIELD

Flextronics, which recently changed its name to Flex, could be one of the biggest companies you have never heard of. With over 200,000 employees and over 1000 customers, Flex produces more than $12 billion in revenue across at least 12 industry verticals. While we once focused on PCs, today we make everything from footwear for Nike to speakers for Bose to floor care products for Dyson and Bissell. While you won't ever see our name or our brand on these products, they represent billion dollar businesses in each of these sectors. Yet, Flex's primary business is not manufacturing. Rather, it is supply chain management, on steroids, with a focus on continuously improving the end-to-end supply chain. Our new book, *The LIVING Supply Chain*, documents the changes going on at Flex in the context of the massive evolution in today's supply chain world. These changes will occur sometimes quickly, sometimes slowly, but will undoubtedly come into being in the next decade. The changes are not just about technology—they are about true evolution—in a biological sense—of the relationships, infrastructure and jobs in the supply chain.

Many of the changes we are seeing at Flex have been captured in a set of insights we call the "New Rules for LIVING Supply Chains." These new rules are aligned with many of the rules that dictate how species, human beings and genetics have evolved, and represent a natural, rather than a radical, evolution to change. They are occurring because the world of global trade is re-shaping the way we operate. In a sense, this world has reached the limits of growth; the new rules will require a new set of management approaches as the traditional approaches will no longer apply.

To understand this new world, a brief history lesson in supply chain management is in order. SCM developed as a field as large organizations saw the need for dedicated functions responsible for the management of materials, which included purchasing raw materials, managing manufacturing processes and moving materials (logistics). The overall objective of materials management was to solve materials problems from a total system cost perspective rather than from the viewpoint of individual functions or activities. The late 1990s saw the introduction of a set of principles known as "World Class Procurement." The idea, promulgated at universities like Michigan State University, where co-author Rob Handfield was a young assistant professor, was that procurement needed to establish a position not just as a "buyer of stuff," but as a centralized function that tabulated spending across both direct and indirect categories of spending, leveraged this volume through purchase power and sought to achieve significant cost improvement.

Driving cost out of the system was also a theme in logistics, where enterprises centralized their distribution centers and warehouses to drive optimization in transportation routing and reduce inventory across the system. Manufacturing, meanwhile, saw the introduction of Lean and just-in-time manufacturing based on the thinking pioneered by the

likes of Toyota. Just-in-time and Lean focused on standardizing products, improving coordination between different enterprises to reduce inventory and only delivering the exact amount needed, in quantities that could be immediately consumed by the follow-on operation.

Speed drives business value and inventory turns, reduces working capital, produces cash, (monetizes) assets and makes customers happy.

Still later came the "Logistics Renaissance," which proclaimed that the role of logistics was to add value and drive market penetration through technology integration. The concept was encapsulated in a "maturity model" that identified how organizations could develop capabilities over time toward a truly "world class supply chain" organization.

However, "world class" still emphasized distinctions in the field. Purchasing, operations and logistics were lumped together as "supply chain" functions, but they never stopped working independently of one another. Professional disputes emerged over which function was really in control of the supply chain. All the while, each claimed to be driving world class practices—implying that they are the best of the best.

In the end, there are some real problems with the world-class view of the supply chain. Although transactional excellence and efficiency is certainly an operative element that forms the basis for excellence, there is a shift away from the idea that world class applies to every situation.

So if world-class supply chain management is no longer the objective, what is the next generation of supply chains going to look like? To answer this, it is important to emphasize that managing supply chains is no longer just about driving cost out of the system, but about a deep understanding of the components of customer value and making decisions quickly in response to sudden shifts in customer requirements.

While cost optimization may well be one element of this equation, value has many contexts and meanings. Managing the supply chain first and foremost requires that managers act as internal consultants who listen closely, not just to the explicit needs of internal customers for materials, information, services, knowledge and capability, but also to the intangible elements of value customers are unable to articulate. In a sense, real-time supply chains involve understanding and predicting what internal users and customers will need next month and next year, even before they themselves recognize that they need it. And velocity and speed is an integral capability that enables quick response to customer needs that produces the right outcome.

Attention to speed and velocity is also an idea promulgated by evolutionary economics and biologists, who emphasize that the organisms and creatures that are quick to respond will evolve more quickly—and will survive. Those that don't? They will die out. In his book: "The Serengeti Rules," biologist Sean Carroll explains why entire ecosystems can get "sick" when the populations of certain members are too low or too high. In fact, these rules provide an excellent set of guidelines for thinking about how supply chains operate as an ecosystem. In this manner, we propose the idea of a "LIVING" supply chain as one of a set of networked enterprises that are subject to biological rules related to the ability to respond—and evolve—quickly.

Why is velocity and real-time transparency so important in the supply chain? An anecdote used by Linton at Flex makes it clear: Think about driving in traffic and suddenly it occurs to you to use the Waze app. This app provides you with real-time data, collecting information from millions of other Waze drivers to give you instructions on how to get to your destination faster, using alternative routes. What if you had Waze for your supply chain? You could move more quickly, get real-time information and updates and provide better service and value.

This analogy points out a simple concept, which is not far from the truth: In the new global era, speed and velocity are more important than everything else. Speed drives business value and inventory turns, reduces working capital, produces cash, (monetizes) assets and makes customers happy. That, in turn, further drives top line revenue. The creation of real-time supply chains provides a means for creating value that the customer cares about, and in today's rapid environment, velocity has customer value. Late deliveries, substandard quality, safety incidents and damaged shipments do not alleviate the benefits offered to a customer for lower prices, as many logisticians and planners will tell you. In many cases, speed not only reduces costs—it also creates customer value.

Tom Linton is the chief supply chain officer of Flex. Robert Handfield, Ph.D., is the Bank of America Professor of Supply Chain Management at the Poole College of Management at North Carolina State University.

Supply Chain Trends

BY ROBERT J. TRENT

The world of supply chain management is exciting, challenging and rapidly changing. According to supply chain managers and executive leaders at a Fortune 50 company, these five trends are affecting the design and management of supply chains.

IF **THE LAST 20 YEARS** have shown anything, it's that the supply chain profession is in a state of constant change. Supply chain professionals who once viewed themselves as cost managers are now managing relationships with key stakeholders, the risks in their supply chains and are increasingly responsible for financial management. What's more, new trends arise almost daily that affect how supply chains are designed and managed.

This article describes five trends that are affecting the design and management of supply chains right now. They have been identified through primary and secondary research, conversations with supply chain professionals—and, perhaps most importantly, working closely with executive leaders at a Fortune 50 company.

While it is unlikely that everyone in the supply chain community will ever agree on the impact of every trend, the five presented here will likely affect the supply chain world for the foreseeable future. Understanding them—and how they might have an impact on your organization—can mean the difference between demonstrating leadership and surrendering to forces beyond your control.

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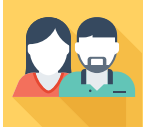
Happening Now

Trend No. 1: Supply chain talent management is becoming a strategic necessity



For some powerful reasons, the need to manage supply chain talent is becoming a strategic necessity. One major study, for example, found that having the right people involved when developing global sourcing strategies was the most important success factor of several dozen factors evaluated. Unfortunately, this same study found that a lack of access to people with the right knowledge and skills when pursuing global initiatives was the most significant barrier affecting global success. Few would argue against the notion that supply chains are becoming increasingly global and complex, something that affects the need for talent management.

Demographic changes are also having a profound impact on talent management. Almost 80% of top HR and IT executives at mid-size to large U.S.-based companies say that the threat of losing critical expertise is more of an issue today than it was five years ago, when the first of the baby boomer generation turned 65 and began to exit the workforce. And, 84% in that same survey say they sometimes or frequently do not have a successor in place when a top manager leaves.

The exodus of talent will result in the loss of something called "deep smarts." Deep smarts represent organizational wisdom and knowledge that cannot be quickly replicated once it is gone. Compounding this demographic change is the fact that the generation behind the Baby Boomers is 11 million smaller.

But it's not just demographics at play. Without question, the transition from tactical supply chains to a more strategic and global model requires a major re-tooling of personnel capabilities. An ever-expanding domain of supply chain responsibilities supports an obvious conclusion regarding the importance of human talent. And, corporations are under intense pressure to increase the number of diverse employees from historically underrepresented groups.

The shift from traditional, defined pension plans in favor of contributory 401(k) plans, where workers are responsible for their own investment

decisions, may also affect the need for talent management. The reason: While 401(k) plans are attractive to corporations due to their lower costs and long-term liabilities, they are portable when an employee leaves an organization. That has the unintended consequence of encouraging job turnover because employees no longer risk losing accumulated pension years.

A final reason to focus on talent management is to avoid an affliction that affects far too many organizations: poorly engaged employees. Engaged employees are those who are involved in, enthusiastic about and committed to both their work and workplace. Gallup, the leader in public opinion polls, has concluded that employee engagement, at least in the United States, is somewhere around 30%. This is troubling because numerous studies have revealed a clear link between employee engagement and organizational health.

A large part of talent management will involve something called talent analytics, which is part of a broader category of techniques called predictive analytics. Talent analytics involves adopting sophisticated methods of analyzing employee data to ensure the highest productivity, engagement and retention of top talent. Kimberly-Clark, a company where employees once believed they had jobs for life, now uses talent analytics software to track and evaluate the progress of salaried workers. The career expectancy of laggards is now much shorter than in years past. Figure 1 presents various kinds of talent analytics—a topic that appears in the later section on predictive analytics.

A growing need to secure, engage and develop talent will demand the attention of supply chain managers. Fortunately, various ways are available for ensuring that an organization is a talent management leader rather than follower. The tactics and techniques presented in Figure 2 provide a well-rounded approach for acquiring and developing human assets—a need that will only increase in importance.

Trend No. 2: Increasing global risk is creating a greater need for supply chain risk management

An increasing number of studies by academics and consulting firms have concluded that supply chain risk is a growing, worldwide phenomenon. The annual Allianz Risk Barometer, a respected gauge of organizational risk, identified business and supply chain disruptions as the top global business risk in 2015 and 2016. In fact, six of the top 10 Allianz barometer risks are supply chain related. Executives disregard the growth in supply chain risk at their peril.

A study by the Aberdeen Group identified various reasons why companies need to embed supply chain risk management strategies, or SCRM, into their corporate culture. First, the need to protect an organization's brand and sources of competitive advantage is a strategic necessity. Risk events have a nasty way of affecting corporate brand value quickly. The volatility of global markets creates greater risk exposure. A study by the International Monetary Fund concluded that the size of fluctuations in commodity prices has more than tripled since 2005 compared to the period from 1980-2005. Third, corporate and government mandates to institute and/or improve risk management and governance programs are only going to increase, forcing an emphasis on financial risk management. Fourth, supply chain risk will continue to increase as companies pursue sourcing and selling opportunities in emerging global markets. Finally, a constant pressure to improve shareholder value will encourage actions that bring greater risk exposure. These factors—individually and collectively—make an emphasis on SCRM a certainty.

FIGURE 1

Types of talent analytics

Six kinds of detailed statistical analytics help companies answer important human resource questions:

- **Talent supply chain analytics** address how workforce needs should adapt to changes in the business environment.
- **Talent value model analytics** analyze why employees choose to stay with or leave an organization.
- **Workforce forecasts analytics** help identify when to increase or reduce staffing levels.
- **Human capital analysis analytics** provide insight into which actions have the greatest impact on the workforce and the business.
- **Analytical human resources** help identify which departments or individuals need attention.
- **Human capital facts analytics** help identify the key human-related indicators that link to organizational performance.

Source: Robert J. Trent

While supply chain professionals have yet to come to an agreement on a standard or accepted approach for categorizing supply chain risk, one way includes four categories, each requiring its own strategies, approaches and responses (see below).

- **Hazard risk** includes events such as random disruptions, some of which are acts of nature. This category also includes accidents and fires. Other hazard risk disruptions involve malicious acts including crime, terrorism and product tampering.
- **Financial risk** includes internal and external financial challenges, particularly with suppliers and customers.

- **Operational risk** includes events primarily within the tactical supply chain space, including poor supplier quality, late deliveries due to port delays, safety issues and excessive inventory due to poor forecasts.
- **Strategic Risk** includes risks arising from decisions made by executive management or risks that are external to the organization but that place an organization's continuance in jeopardy.

Figure 3 describes the current state of supply chain risk management identified during a Center for Advanced Purchasing Studies (CAPS Research) research project. The items in this table are the result of extensive research with leading companies. They reveal a current state where SCRM is primarily ad hoc and reactive rather than systemic and proactive.

As risk management capabilities mature we expect company attitudes toward risk to shift away from risk avoidance and toward more thoughtful risk taking. We also expect risk management to become an embedded part of supply chain initiatives, including during the development of new products and commodity strategies. Furthermore, a risk management model that features "pockets of excellence" will move toward a company-wide risk excellence model. And, enterprise risk management (ERM) and supply chain risk management (SCRM) will increasingly overlap as supply chain risks become corporate-level risks.

Companies will also emphasize risk management efforts past tier-one suppliers and customers, something that occurs infrequently today. We also expect a new set of supply chain risk metrics to emerge, including value-at-risk and time-to-recovery metrics, as well as real-time, predictive analytic indicators. Total cost of ownership (TCO) models will also increasingly become part of the risk management process. As supply chain risk management continues to evolve as a discipline, we should also expect the development of a wide range of risk planning tools and approaches as third-party risk management solutions increasingly replace homegrown approaches. One thing is certain: betting on growth in the attention paid to supply chain risk is a winning bet.

Trend No. 3: Competitive pressures are forcing supply chain managers to become financial managers

Over the last 30 years, large North American and European multinational corporations have enjoyed one of the strongest periods of prosperity in modern economic history. But, that era appears to be ending. New rivals, including technology disruptors and non-governmental firms in emerging markets, are putting established incumbents on notice. These new entrants often play by different rules and demonstrate an agility and aggressiveness that many larger Western companies will struggle to match. That is bringing financial pressures to the fore across organizations—including the supply chain.

FIGURE 2

Approaches for acquiring and developing talent

Acquiring talent

- Develop close recruiting relationships with a select group of colleges
- Establish internship programs that link to hiring requirements
- Recruit talent from outside the company
- Recruit management consultants
- Recruit talent from non-supply chain groups internally
- Recruit honorably discharged military personnel

Developing and retaining talent

- Assign high potential personnel to team leadership assignments
- Develop leadership mentoring programs
- Develop leadership rotational programs
- Provide continuous training/professional development opportunities
- Map career paths and develop career ladders
- Routinely survey employee workplace satisfaction
- Make employee training available on a customized and just-in-time basis
- Reward employees for skill and knowledge advancement through formal education and training
- Use talent analytics to gain objective insight into talent management requirements
- Develop clear succession plans

Source: Robert J. Trent

It is not hard to find respected voices making the case that supply chain managers need to act like financial managers. MIT's Jarrod Goentzel and James B. Rice Jr. noted in the *Wall Street Journal* that supply chain management and financial management are intertwined, and that the time has come for supply chain professionals to assume a greater financial perspective. McKinsey researchers wrote in the *Harvard Business Review* that in an age of hyper-competition and reduced margins, companies must search for talent that understands how to manage costs and improve profits. Something we know for certain is that everything that supply managers do shows up on the balance sheet, the income statement and/or the cash flow statement. Supply chain management and financial management are intimately linked.

What does it mean to say that supply chain managers should think and act like financial managers? Within the supply chain space, it means focusing on five areas that

have clear overlap between supply chain management and financial management.

Knowing more about your suppliers and customers than they likely know. Knowing more about your suppliers and customers than they likely know involves three assessments: financial ratio analysis, calculating the potential for supplier or customer bankruptcy and evaluating qualitative indicators. For instance, shipping early to customers due to a lack of orders is a qualitative indicator that might indicate supplier problems. Supply chain managers perform these three types of assessments to manage business risk and to eliminate marginal suppliers or customers early in the supplier and customer selection process.

"R" you ready to run with the big dogs? Few would argue that financial indicators that start with "return on" tend to be the "big dogs" of the finance world. The ability to show the impact of supply chain initiatives on corporate level indicators, rather than simply tactical or operational metrics, is evidence of speaking at an entirely different level. Modeling the impact of increased inventory turns on return-on-assets (ROA) using the DuPont Model, for example, is an indication that supply chain managers appreciate the language of finance. And, any supply chain manager who can show the impact of her group's initiatives on return on invested capital (ROIC) will find herself on the corporate fast track.

FIGURE 3

The current state of supply chain risk management

- The financial impact of supply chain disruptions can be devastating but are often not understood until after a risk event takes place.
- The supply chain management profession has become too comfortable with deterministic models and tools, such as traditional forecasting, over the last 35 years. A need exists to develop probabilistic risk models that utilize scenario planning.
- Supply chain risk management (SCRM) is an evolving discipline and will remain so for the foreseeable future.
- Supply chain strategies driven primarily by cost and delivery improvements are no longer comprehensive enough to manage today's supply chain risks, some of which are strategic.
- Showing a hard ROI for risk management initiatives is a difficult task, making the use of traditional investment analytic techniques a challenge.
- Social media (such as Twitter) is an unpredictable risk wildcard.
- Global supply chain risk is increasing, on average, rather than decreasing worldwide.
- The risk ledger has two sides—risk presents an opportunity to some while others see it as the potential for loss.
- Reactive risk heroics and reaction must give way to risk prevention wherever possible.
- Organizations need to take an end-to-end (i.e., sub-tier) rather than narrower view of supply chain risk management.
- Supply chain risks are becoming enterprise-level risks as they increasingly appear on SEC mandated 10-K reports.
- Many companies have developed internally their risk management tools due to an absence of third-party developed applications.

Source: Robert J. Trent

Expenses are bad, investments are good. Most supply chain initiatives are presented in terms of expenses. And of course, the prevailing wisdom among managers is that expenses are to be avoided wherever possible. The challenge from a financial perspective is to reframe supply chain expenses so they are presented as investments, which are viewed more positively among executive managers. Framing a supply chain initiative, such as a supplier development project, as an investment opportunity requires an understanding of investment analysis techniques, including payback, net present value (NPV) and internal rate of return (IRR). Changing how these projects are framed will affect how executive managers view them.

Manage working capital the right way. To finance managers, improvements to the cash conversion cycle (defined as days inventory outstanding + days receivables outstanding – days payables outstanding) is largely about extending the payables period to suppliers. Unfortunately, this usually harms, sometimes irreparably, the supplier-buyer relationship. Enlightened managers know that a less contentious way to manage working capital from a financial perspective involves managing inventory from a system-wide perspective. Anyone can decide not to pay suppliers in a reasonable time.

Don't make decisions with incomplete information. The ability to arrive at better supply chain decisions requires total cost models that rely on financial and other performance data. These models may examine the total cost of equipment over a life cycle; calculate a Supplier Performance Index (SPI) that calculates the total cost of poor quality; or identify the total landed cost of material and components sourced from suppliers. Recognizing that unit cost never equals total cost is at the heart of whatever total cost model is used.

Supply chain professionals must appreciate the language of finance. And, they must understand how to apply financial tools and techniques to support better decision making and risk management. These professionals must also demonstrate the value they create by showing how supply chain initiatives affect important corporate indicators.

Trend No. 4: Pressure to increase top-line growth supports greater innovation sourcing and collaboration

Innovation sourcing is not likely a familiar term to readers. It involves the process of capitalizing on external supply chain innovation and capabilities with the explicit goal of growing top line revenue. This differs from an environment where supply chain personnel focus their efforts almost exclusively on reducing costs.

The logic behind innovation sourcing is straightforward. Without question smart people work at other companies as well as your own. And, external R&D at those companies can create considerable value, particularly when a third party is a technical specialist, while internal R&D works to capture that value. It is myopic to believe that innovation has to originate internally for a company to profit from it. Companies should develop a business model where they profit as others use their intellectual property, while at the same time they pursue others' intellectual property when it advances their own business needs.

A logical question becomes how to gain advantage from innovation sourcing and collaborative relationships, where all parties share in the risk and rewards. Perhaps the most powerful way is to engage suppliers and customers in something called early involvement. Early involvement is the process of relying on suppliers and customers early, physically or virtually, to provide support during strategic planning, demand and supply planning, continuous improvement projects, project planning and new product, process and technology development.

Early involvement often involves external participation on teams. This involvement can be a powerful way to tap into the expertise of third parties. Research findings are clear that teams that rely on supplier input and involvement when the task warrants involvement are more effective in their task, on average, than teams that do not involve suppliers. We also know that teams that include suppliers as participants report a variety of improvements that relate directly to better performance.

Identifying the appropriate suppliers to involve early can be a challenge. Figure 4 presents a simple but effective tool (simplicity is a virtue here) for assessing early involvement candidates. Because early involvement opportunities are usually limited, special care must be taken to manage this process and any related issues. An example of one such issue is how to manage intellectual property that is developed jointly.

As companies search for new growth, they also cannot ignore the importance of what is largely an untapped opportunity: the receipt of preferential treatment from suppliers. Oftentimes, this treatment is specific and not available to other firms, particularly competitors. Make no mistake, preferential treatment—like trust and respect—is earned rather than given. How an industrial customer engages with its suppliers can mean the difference between receiving game-changing innovation that leads to top-line growth versus watching from the sidelines as others prosper.

One way to ensure that a customer becomes preferred is to use reverse scorecards, such as the *Supplier Satisfaction Survey,* to measure supplier attitudes toward their customers. The premise of a reverse scorecard is to identify ways to continuously improve a buyer's performance with the objective of earning preferred customer status. The reality is that few firms routinely survey their suppliers, making this an untapped opportunity.

Customers that put forth the effort to understand the needs of their suppliers and then respond accordingly should be better because of that effort. The challenge becomes one of replacing subjective analysis and conjecture with an objective understanding of supplier needs and wants. The bottom line is that a need to tap into supplier innovation that enhances top-line growth is best supported by relationships that are trust-based, collaborative and explicitly consider a supplier's needs.

Trend No. 5 : A need to understand and influence events is accelerating the use of predictive analytics

Without question, predictive analytics is a hot topic at the corporate and academic level. Also known as Big Data, business intelligence, data analytics and business analytics, predictive analytics uses techniques from data mining, statistics, modeling, machine learning and artificial intelligence to analyze current data in order to make predictions about the future.

While predictive models and techniques, such as Statistical Process Control (SPC) and supplier and customer bankruptcy predictors, have been around for years, the increasing relevance of predictive analytics coincides with the amount of data being captured from individuals (for example, from

on-line transactions and social networks) and sensors (the Internet of Things), as well as the availability of cost-effective processing power, be it Cloud or Hadoop-based. Without question analytics tools are more rigorous today, particularly in their ability to glean insights from unstructured data, such as videos. Traditional predictive tools and techniques rely largely on deterministic models and structured data sets.

Predictive analytics is part of a hierarchy of analytics that address some important questions. The hierarchy consists of the three distinct levels outlined below.

FIGURE 4

Identifying early involvement candidates

Performance improvement potential due to early involvement	Limited 1	2	Moderate 3	4	Extensive 5
Relationship between the buying company and the supplier	Adversarial 1	2	Cordial 3	4	Cooperative 5
Willingness of the supplier to participate in early involvement	Not willing 1	2	Somewhat 3	4	Very willing 5
Capability of the supplier to support early involvement activities	Not capable 1	2	Moderately 3	4	Very capable 5

Source: Robert J. Trent

- **Descriptive analytics** use data aggregation and data mining to provide insight into the past and answer: "What has happened?" Descriptive analysis (i.e., statistics) summarizes raw data and makes it something that is interpretable by humans. They are analytics that describe the past.
- **Predictive analytics** use statistical models and forecasting techniques to understand the future and answer: "What could happen?" These analytics are about understanding the future. Predictive analytics provides companies with actionable insights based on data.
- **Prescriptive analytics** use statistical models and forecasting techniques to answer: "What could happen?" These analytics are about understanding the future and provide companies with actionable insights based on data. While predictive analytics will be applied across all business disciplines, supply chains will benefit greatly from this technology. The following examples comprise a small set that illustrates where supply chain-related areas are capitalizing on Big Data.
- **Telematics** involves the branch of information technology that deals with the long-distance transmission of computerized information. Using sensor technology, truck fleet owners can monitor the real-time performance of transportation vehicles, including location, engine performance, fuel consumption, driver habits and predicted mechanical issues. Remote telemetry is also being used to gather real-time data, such as predicting remotely the need to replenish raw materials at customer locations.
- **Wearable technology** involves technology that is worn by a human to monitor human vital signs. One application in the supply chain space is to monitor brain waves to identify if vehicle drivers are falling asleep.
- **Delivery tracking** involves real-time monitoring of freight shipments and deliveries to predict early, on-time or late supply chain deliveries.
- **Smart sensors,** as part of the Internet of Things (IoT), will feature sensors that collect and communicate data on a wide range of conditions. Equipment will no longer be maintained or repaired on a maintenance schedule; instead, maintenance will be based on predicted need. In the rail industry, trains will arrive in yards for maintenance with pre-positioned yard crews that already have an understanding of the maintenance requirements of the engine and rail cars.

Weather analytics helps predict supply disruptions, forecast effects on future demand, analyze the effect on fuel prices and sense transportation hub congestion to dynamically re-route to less congested locations.

Most companies are asking themselves, "We have all of this data, why don't we do something with it?" Predictive analytics represents their attempts to "do something with it."

Get in front of trends

Understanding the macro trends that are occurring within the supply chain space is an essential component of supply chain success. The trends presented here are real, they are happening now and they will affect the domain of supply chain management for years to come. A failure to get in front of these trends places an organization at risk—particularly when competing against others that truly understand the changes affecting their supply chains.

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Aligned and Optimized

All too often considerable managerial resources are directed toward planning activities and processes with little in the way of tangible results. That's because their supply chain strategy is not aligned with the business strategy. Here are proven, practical techniques used by the authors to align and optimize supply chain operations management and planning in private industry. Call it: The Power of Frameworks.

BY TAN MILLER AND MATTHEW J. LIBERATORE

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In today's competitive global economy, a firm's market position and financial performance is closely linked to its supply chain performance. All too often, considerable managerial resources are directed toward planning activities and processes that deliver little in the way of tangible results and beneficial outcomes. What supply chain executives want is the know-how to efficiently and effectively direct their planning activities so that the results lead to better business decisions from the long-term down to day-to-day operations. What they often end up with is a set of unaligned decision-making processes that result in uncoordinated, inefficient planning and operations.

There is a better way: using Supply Chain Frameworks to oversee and guide planning and operations. Supply Chain Frameworks organize and manage all supply chain activities and decisions as a set of "linked" steps and processes that are part of one unified system, enabling managers to achieve high levels of operating effectiveness and efficiency.

In this article, we present proven, practical management frameworks and techniques that we used to support supply chain operations management and planning in the private sector. These frameworks provide methodologies for organizing and managing critical activities such as supply chain strategic planning and project selection, integrated manufacturing and distribution planning, performance measurement and warehouse planning and operations, to name a few.[1]

1 For highly detailed descriptions of implementations of all these and many other frameworks, and other related planning aspects such as feedback loops, see Liberatore, M. and Miller, T., Supply Chain Planning: Practical Frameworks for Superior Performance, Business Expert Press, New York, 2012, ISBN-13: 978-1-60649-316-8 (paperback), ISBN-13: 978-1-60649-317-5 (e-book). In this article, we will present an overview of the generic framework methodology and summaries of two specific examples.

We also illustrate how managers can and should employ planning frameworks to organize and manage all major supply chain functions and activities. While a firm clearly must have a framework to guide its overall supply chain strategic planning process, so too should the firm have a well-established planning framework for its individual supply chain functions such as transportation, manufacturing and logistics. Further, and most critically, all these supply chain planning frameworks must support and align with the firm's overall business goals and objectives.

FIGURE 1

Integrated business and supply chain strategic planning framework

Source: Authors

Why are supply chain frameworks critical to a firm's success?

A supply chain framework is a formal planning system that organizes and links all supply chain activities. The first step in developing a supply chain framework is to "diagram or map" all the major activities and components of a firm's supply chain planning and execution systems. This allows managers to better understand how all the components of the system affect each other.

Firms that actively employ supply chain planning frameworks as a standard business practice give themselves a true competitive advantage. By embracing the methodologies and discipline fostered by a framework-based approach, firms make themselves agile, and are therefore capable of effectively and rapidly responding to ever-changing business conditions.

Leading edge characteristics of these firms include the ability to link and coordinate their planning activities and actions from the long-run, strategic horizon to the medium-term tactical and short-run operational horizons. The linkages between planning levels is hierarchical, meaning that plans developed at the strategic level guide and direct the tactical level, and plans developed at the tactical level guide and direct the operational, or execution, level, so that all plans and actions are in alignment with the firm's high level strategy. This overarching hierarchical perspective provided by well-implemented supply chain planning frameworks facilitates improved decision making, higher customer service levels and improved operating efficiencies for firms.

To set the stage for the remainder of this article, we now introduce two "linked" frameworks:

1. a business and supply chain planning framework; and
2. a supply chain function planning framework.

A business and supply chain planning framework

Figure 1 presents a simple framework depicting an integrated process where a firm's overall business goals and objectives define its supply chain organization's goals and objectives. Specifically, in its business strategic planning process, a company must address such key issues as overall corporate objectives, market share and profitability goals, and business and product mix targets. Strategic planning decisions relating to overall corporate objectives then drive strategic supply chain plans and decisions. For example, market share and product mix objectives will strongly influence a firm's supply chain capacity and service strategies. A desire to increase market share may translate into a requirement that a firm expand its manufacturing capacity.

Other high-level supply chain strategies are also developed at this stage to support business goals and objectives. Examples of such strategies would include setting targets for overall customer service levels and maximum inventory investment levels, and creating key customer strategic initiatives.

Once a firm's supply chain planning team has established its high-level strategies, the functions within this organization must then develop and implement their individual strategies. As Figure 1 depicts, functions such as manufacturing, logistics and transportation each must plan their own strategies to support overall supply chain goals and objectives, and ultimately those of the business. For example, the manufacturing organization's plans must address such issues as planned production capacity levels for the

next three years and beyond, the location and number of facilities its plans to operate, and so on. Other functions such as logistics, transportation and procurement will face different but similarly critical issues and decisions. Shortly, we will review in greater detail what we describe as an integrated business and supply chain planning framework. For now, however, as illustrated in Figure 1, this integrated strategic planning process consists of three components:

1 business strategic planning, which drives and guides;
2 supply chain strategic planning, which drives and guides; and
3 strategic planning by individual supply chain functions.

The distinction between steps 2 and 3 is as follows: In step 2, the senior leaders of the supply chain organization (i.e., the leaders of all the individual supply chain functions) collectively establish the high-level strategy for their organization, while in step 3, each individual supply chain function (e.g., manufacturing) develops a strategic plan for its own organization that supports the overall supply chain plan generated in step 2.

To illustrate this integrated process, consider the following brief example. Let's assume that the business unit strategic planning process results in a decision that production capacity should be increased by 40% over the next five years to support planned sales growth (step 1). The supply chain strategic planning team receives this input, and its planning process (step 2) then determines that the firm will generate this capacity increase through internal expansion rather than using third party contract manufacturing. Plans developed at the overall supply chain level may be more specific—such as a general decision that capacity should be added specifically in Southeast Asia. The level of detail specified in step 2 will vary by firm. Next, in step 3, the manufacturing group engages in its individual strategic planning process. At this level, manufacturing generates a detailed strategy addressing such issues as the specific location where it will build additional capacity, the technology planned for the facility, and the targeted labor versus automation mix. Similarly, each other major supply chain function such as transportation will also conduct its strategic planning process in support of the overall supply chain strategic plan. This completes the three-step integrated business and supply chain strategic planning framework.

We next introduce a framework for individual supply chain function planning where the planning process becomes much more detailed. To accommodate the granularity required at this level, each supply chain function must utilize a hierarchical planning framework that can address all issues ranging from the long-run strategic to the short-run operational.

A hierarchical supply chain planning framework

The planning activities and decisions that management must make for a supply chain function range from those requiring vast resources and managerial time (as measured by cost, required planning inputs, level of risk and other attributes) to those requiring relatively minimal time and resources. For example, consider the vast differences in the required inputs for, and implications of, a plant location and sizing decision versus a one-week production line scheduling decision. To effectively address this broad spectrum of management and operational control activities and decisions required in any major supply chain function (e.g., manufacturing), it is necessary to separate the future planning horizon into three buckets:

- strategic planning;
- tactical planning; and
- operational planning.

These three planning horizons must be closely and hierarchically linked to ensure aligned decision making.

A generic framework for supply chain planning and management

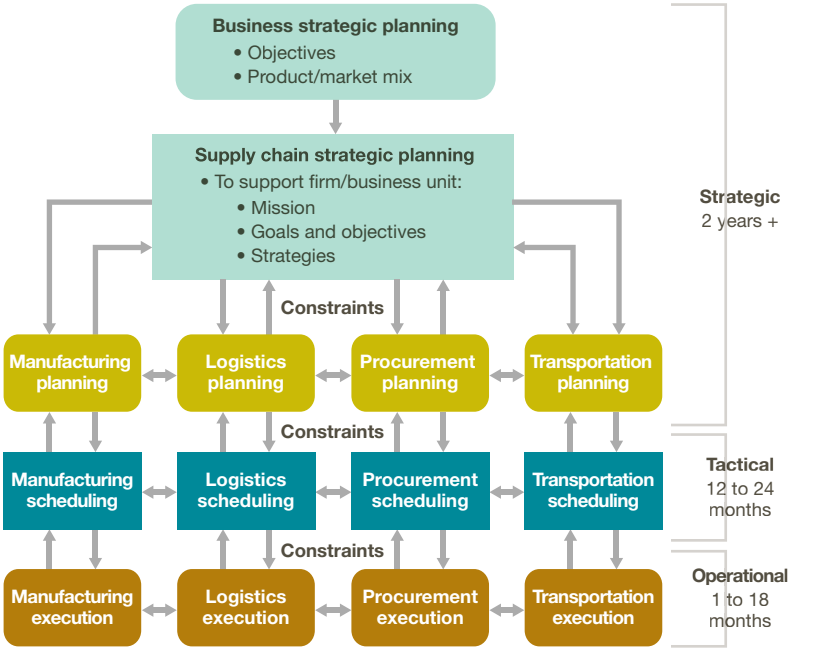
Now we link the strategic business and supply chain planning framework and the hierarchical supply chain planning framework to form the unified business and supply chain planning framework displayed in Figure 2.

We describe this framework as generic because it illustrates how the planning activities of any individual supply chain function can (and should) be linked into the overall business and supply chain strategic planning process of an organization. The definition of what constitutes a major individual supply chain function will vary by firm. For example, some firms may consider transportation and/or customer service as components of their logistics organization, while other firms may not. Regardless of how many functions within a supply chain organization a firm chooses to define as major individual units, the framework in Figure 2 provides a well-defined, holistic organizational approach.

As described previously, this framework begins with the

FIGURE 2

A unified business and supply chain planning framework



Source: Authors

business strategic planning and then the supply chain strategic planning processes. The outputs of these processes generate high-level requirements and define capabilities that the individual functions within supply chain must then deliver. Further, the outputs of this process may also identify projects that can best help to achieve the plans developed at this overall supply chain level. At this point, individual functions such as manufacturing must initiate their own planning processes to map out the respective contributions that they will make in support of the overall supply chain plan.

At the individual function or department level, it is beneficial to delineate the future planning horizon into strategic, tactical and operational planning buckets. Thus, each supply chain function has its own three level planning process.

To illustrate the different types of decisions and management controls exercised at each planning level, note in Figure 2 that at the tactical level we use "scheduling" as a function descriptor, while at the operational level "execution" is the function descriptor. In practice, at the tactical level one observes both planning and scheduling activities, while at the operational level, planning, scheduling and execution activities all occur. Note also that while Figure 2 shows only four supply chain functions for illustrative purposes, some firms will have more than four major supply chain functions. Finally, in Figure 2 also note the following:

1 There are bidirectional vertical lines between the strategic, tactical and operational planning levels of each supply chain function (e.g., manufacturing). A line emanating from a lower level to a higher level is known as a "feedback loop" in a hierarchical planning system.

2 There are horizontal lines between the individual functions. These lines illustrate that in practice, interactions in many forms should (and do) occur between individual supply chain functions. These interactions can be both formal (e.g., joint planning sessions) and informal (e.g., day-to-day communications).

In summary, the generic supply chain planning framework depicted in Figure 2 facilitates a firm-wide planning process whereby strategic plans initially formulated at the business unit level receive aligned planning, scheduling and execution support all the way down to the operational level of each individual supply chain function.

Decision support systems and performance metrics

Now that we have introduced a unified, integrated process for business and supply chain planning, we need to discuss some key planning and control tools to facilitate this process. In this section, we briefly introduce two essential tools of a firm's planning and control processes:

1 decision support systems, and

2 performance measurement systems.

Decision support systems (DSS) for supply chain planning span a broad array of methodologies and techniques ranging from data base analyses and data mining to simple spreadsheet based analyses, to sophisticated mathematical optimization and simulation models, and statistical analyses. It is important to recognize that a firm must develop and maintain DSS tools to support activities at each level of its planning horizon (i.e., the strategic, tactical and operational levels).

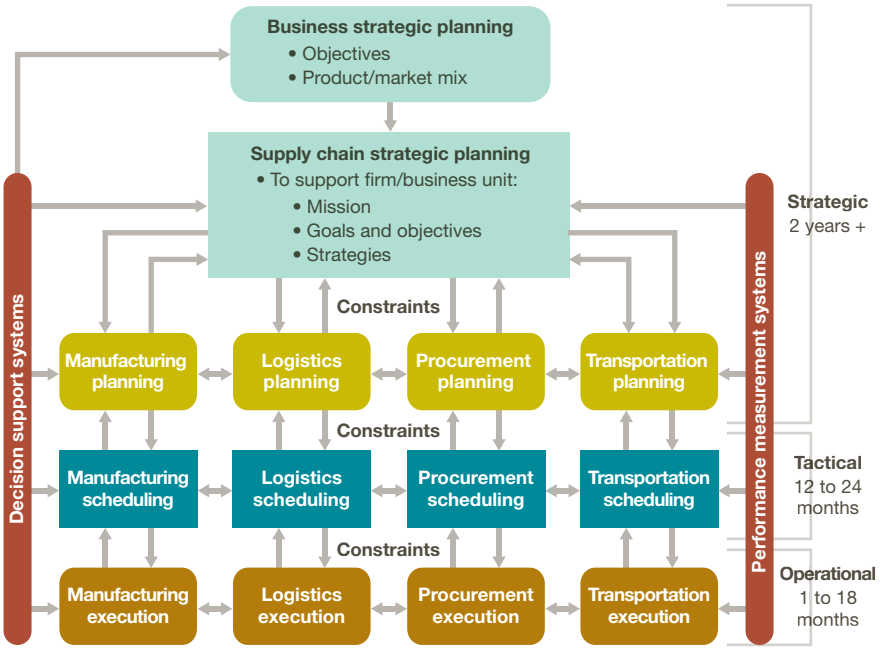
Performance measurement systems provide managers with indicators of how efficiently and effectively their supply chain is operating. Additionally, good performance measurement systems (PMS) also offer advance warnings or indications of potential future problems on a supply chain. A good PMS is also an absolute necessity to support the planning frameworks of a supply chain organization.

Figure 3 depicts the integral role that decision support and performance measurement systems play in the business and supply chain planning framework.

As illustrated, each individual supply chain function must have appropriate DSS tools at each level of its planning process. Similarly, each function must also have pertinent performance metrics to monitor its activities. And collectively, the supply chain organization must have the DSS and PMS tools required to manage the entire process.

FIGURE 3

DSS and PMS integration into business and SC planning framework



Source: Authors

A firm with good supply chain frameworks, but which lacks the proper DSS and PMS tools cannot succeed. Similarly, a firm with strong DSS and PMS capabilities, but which lacks the appropriate supply chain frameworks to organize and utilize these tools cannot succeed. Only the combination of good supply chain frameworks, complemented by strong decision support and performance measurement systems, will facilitate effective supply chain planning and successful operations. To conclude this article, we next present two examples of "functional" hierarchical supply chain planning (HSCP) frameworks and systems.

A warehouse planning and operations example

The warehouse planning process begins at the network-wide strategic planning level where a firm must determine how warehouse operations fit into its overall strategic plan. Figure 4 provides a high-level overview of this hierarchical planning process that begins at the strategic level.

A first step in the planning process consists of determining the mission of the overall warehouse network and the individual locations that will make up the network. As is well known, not all warehouses on a network will necessarily have the same mission or play the same role. The number of warehouse echelons to establish represents another common strategic network design question that heavily influences the mission of individual warehouses.

For example, a firm must decide whether it will operate a single echelon network in which every warehouse will receive shipments of all products directly from all plants, or alternatively does the firm want to operate a multi-echelon warehouse network where one or more first echelon, central warehouses receive products from plants and then redistribute some or all products to second echelon regional warehouses. Another important strategic decision concerns the question of whether a firm chooses to operate its own facilities or to outsource some or all of its warehouse operations to third party providers. Finally, as Figure 4 illustrates, total network warehouse capacity requirements and the economies of scale trade-offs are two additional key determinants of the interrelated decisions on network design, facility design and warehouse

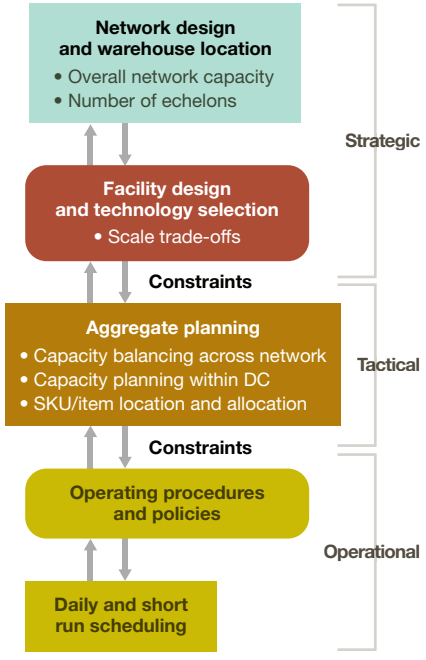
technology selection.

At the tactical level, a firm must concern itself with such planning activities as balancing the demand for warehousing capacity across its network, and planning the most efficient and effective utilization of its capacity at each individual DC. Capacity planning at the individual DC level can involve determining the overall labor level and mix required to meet the projected demands over the planning horizon, the proper mix and use of available storage locations (e.g., type of racking where adjustable), and so on.

In general, tactical warehouse planning focuses on the determination of how to best employ the existing network infrastructure (i.e., the existing warehouses and materials handling equipment). Additionally, decisions to purchase relatively minor additional warehousing assets (e.g., incremental material handling equipment, racking, etc.) will occur in the tactical planning process. Major infrastructure issues that a firm cannot resolve at the tactical planning level (e.g., inadequate network capacity to meet forecast long term warehouse throughput or storage requirements) must typically be fed back up to the strategic planning level for resolution. Thus, the efficacy of hierarchical warehouse planning and scheduling relies upon feedback loops, as do most supply chain functions.

FIGURE 4

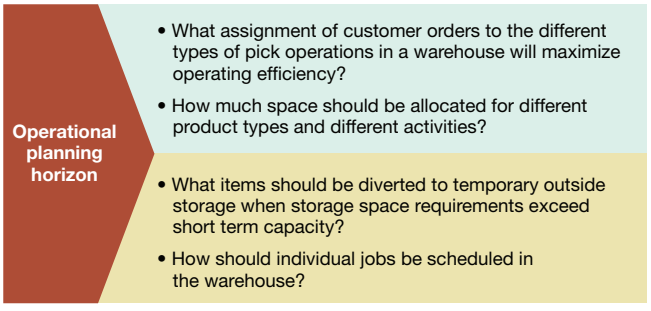
Hierarchical warehouse planning



Source: Authors

FIGURE 5

Illustrative operational warehousing decisions



Source: Authors

At the operational level, a broad assortment of warehouse planning and scheduling activities takes place on a regular basis. Figure 5 illustrates a sample of key decisions that operational schedulers must address. The scheduling of labor and short-term assignments of items to storage locations represent two of the major operational planning activities. Typically, it is the non-routine components of these activities (e.g., addressing temporary storage requirements that significantly exceed capacity) that require the most critical attention. It is also typically the exceptions or non-routine requirements of operational planning and scheduling that planners must report, or "feed back," to the tactical planning level.

For example, when warehouse planners consistently find themselves having to schedule unplanned outside storage because of insufficient facility storage capacity, they should send this information to the tactical level for resolution. Perhaps the overall warehouse network is out of balance and requires realignment because excess storage capacity exists at certain warehouses, while other warehouses face the opposite situation. Alternatively, perhaps this storage capacity issue at one warehouse is not an imbalance issue, but rather is occurring regularly across the network and requires a total network solution. This represents just one simple example of the feedback loops that must exist between the operational and tactical warehouse planning levels.

A manufacturing planning and operations example

In our illustrative hierarchical manufacturing and distribution planning framework, business unit strategic plans have been developed and approved, as have the high level strategic plans of the overall supply chain. Now

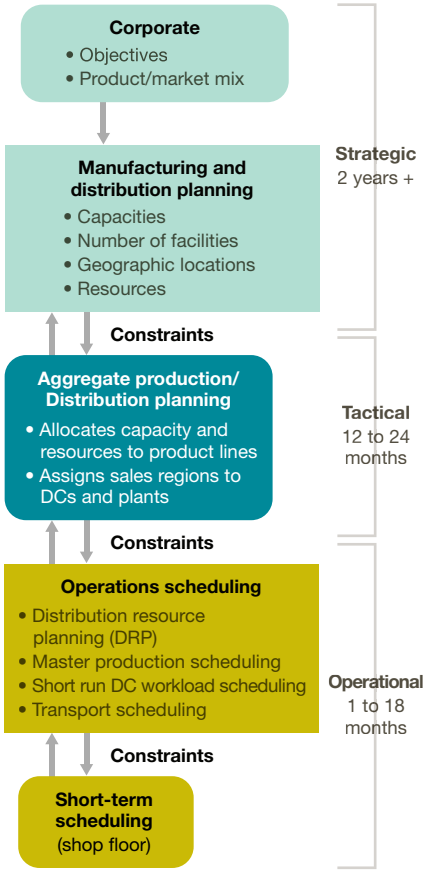
the manufacturing and distribution functions commence their own strategic planning processes to support the overall supply chain and business unit strategies.

At the strategic manufacturing planning level, the company must address such issues as planned production capacity levels for the next three years and beyond, the number of facilities it plans to operate, their locations, the resources the company will assign to its manufacturing operations and numerous other important long-term decisions.

Decisions made at the strategic level place constraints on the tactical planning level. Typical planning activities at the tactical level include the allocation of capacity and resources to product lines for the next 12 to 18 months, aggregate planning of workforce levels, the development or fine-tuning of distribution plans and numerous other activities. Within the constraints of the company's manufacturing and distribution infrastructure (an infrastructure determined by previous strategic decisions), managers make tactical planning decisions designed to optimize the use of the existing infrastructure.

FIGURE 6

Integrated manufacturing and distribution planning framework



Source: Authors

Planning decisions carried out at the tactical level impose constraints on operational planning and scheduling decisions. At this level, activities such as distribution resource planning, rough cut capacity planning, master production scheduling, shop floor control scheduling and many other decisions occur.

As previously noted, the feedback loops from the operational level to the tactical level and from the tactical level to the strategic level represent one of the most important characteristics of the HSCP system illustrated in Figure 6. A true HSCP system is a closed-loop system that employs a top-down planning approach complemented by bottom-up feedback loops. Given the emphasis of HSCP systems on evaluating capacity levels and imposing and/or communicating capacity constraints from higher levels down to lower levels, it is imperative that strong feedback loops exist.

As is well known, production and distribution plans that appear feasible at an aggregate level can often contain hidden infeasibilities that only manifest themselves at lower, more disaggregated levels. Without the proper feedback loops embedded into a hierarchical planning system, the danger that a company will attempt to move forward with infeasible plans always exists. These infeasibilities often do not surface until a company is in the midst of executing its operational plans and schedules.

Competitive and agile

In this article, we have described a planning methodology for supply chain managers that utilizes hierarchical frameworks to organize and align both individual supply chain functions, as well as an entire firm's planning and operations from the strategic level to the daily operational level. The planning systems and components of these frameworks will vary based on the requirements of individual firms and their major functional activities. However, all hierarchical framework based systems share the common characteristic that they organize and synchronize planning activities and operations from the long run to the short run.

This comprehensive perspective and alignment facilitates efficient and effective planning and decision-making within a firm. All the methodologies and frameworks we present and reference can readily be implemented. Our experience has taught us that firms that place strong emphasis on these approaches make themselves significantly more competitive and agile relative to firms that under-invest in these areas.

How agile is your supply chain?

Zara has earned high marks for its agile supply chain. Despite its success, manufacturers heavily invested in Lean believe that the retailer's approach could never work for them. What are the misconceptions about agility and how can they be overcome?

BY MARK BARRATT AND SIMON EAGLE

While recently talking to a senior supply chain executive from a U.S.-based CPG manufacturer, the conversation turned to Zara's customer responsive, agile supply chain—a strategy that is based on the use of local suppliers, large amounts of spare distribution center capacity and strategically placed time-based buffers. The manufacturer's response was one of shock: "*Fifty percent spare capacity is just a huge big waste, and therefore a cost that we cannot even come close to justifying*." This reaction—and misconception—is typical of most if not all manufacturers. It is especially true for those that are the most heavily invested in Lean manufacturing and have spent years driving waste and cost out of manufacturing operations and supply chains. Yet local supply and spare capacity are precisely what allows Zara to identify and respond to new trends by designing, manufacturing and delivering new fashions to its stores in a fraction of the time of traditional retailers.

Why do these misconceptions of agility exist and how can they be overcome? How can CPG manufacturers and retailers develop an agile capability that will significantly improve their supply chain performance? To answer these questions, let's begin by looking briefly at what exactly supply chain agility means.

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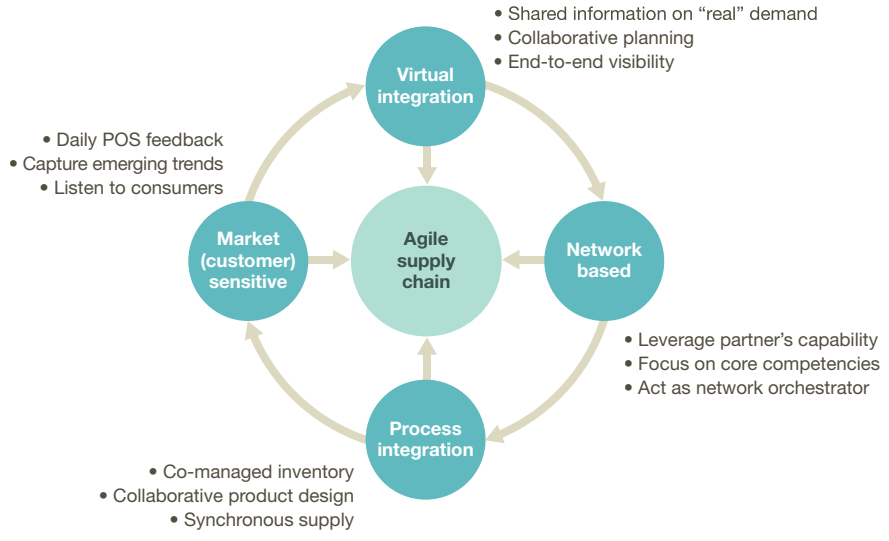
What is supply chain agility?

In essence, agility is the ability of a supply chain to autonomously respond to demand—and its variations—with buffers that are minimized, albeit of the right size, and in the form that best serves both the company and its customers. Finally, those buffers are part of the supply chain design.

Responding autonomously means responding to changes in demand immediately and without prior thought and preparation. Buffers are always associated with variability unless the supply chain is so flexible that it is able to meet demand exactly while operating at 100% utilization without customers either being kept waiting or supplied from existing inventory of finished goods. The aggregate of these various buffers—such as time, capacity and inventory—should be minimized in terms of their cost generation and be in a form that delights the customer, rather than meeting only some basic customer needs.

FIGURE 1

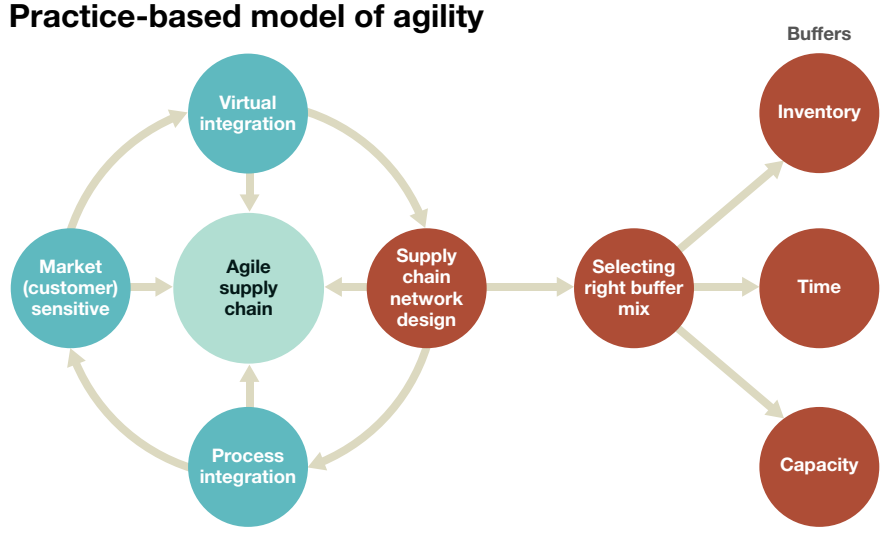
An academic model of agility



Source: Adapted from Harrison, van Hoek and Christopher, 1999

FIGURE 2

Practice-based model of agility



Source: Adapted from Harrison, van Hoek and Christopher, 1999

Agility misconception #1: Academic vs. practical models

The first misconception of agility occurs in relation to an academic model of agility that first appeared in the late 1990s. Figure 1 presents the earliest model of supply chain agility, published in 1999 in the *Institute of Logistics & Transport*, suggesting that the "agility" comes from the relationships between being market sensitive, that is listening to the customer, receiving daily POS feedback and capturing emerging insights; virtual, or sharing demand information and collaborative planning for end-to-end supply chain visibility; process integration, or the process of jointly managed inventory, collaboratively designing products and maintaining a source of synchronous supply; and finally, network-based, the process of leveraging

the capabilities of partners, focusing on core competencies and acting as a network orchestrator. While this correctly lays out the concept of agility, it does not expand on its operationalization and of the role of structure and functioning of the supply chain, other than it being network-based.

Figure 2 presents a revised practice-based model of supply chain agility, in which the structure of the network is expanded to include the selection of the right mix of buffers (such as inventory, time and capacity) that when taken together play a significant role in creating the agile capability of the supply chain.

It should be noted that the use of buffers is not a new concept, but their inclusion explicitly demonstrates that agility is also about how buffers are selected, deliberately positioned, used and minimized as a means of delivering competitive advantage and the flow of product across the supply chain.

- **Inventory buffers.** These are kept on-hand within the supply chain to dampen variability in supply and demand and to provide a quick response. This type of buffer is used by retailers and manufacturers in sectors such as grocery, consumer packaged goods, life science and home appliances to provide ex-stock service.
- **Time buffers.** These are based on the principle of postponement or assemble-to-order (ATO). Zara's use of 200 local sewing suppliers, for example, dramatically reduces the lead-time of assembly and delivery, compared to that from possible low-cost offshore suppliers. An alternative example of a time-based buffer would be the concept of engineer-to-order (ETO), which is used for ship building, luxury yachts and oil rigs, where the customer is prepared to wait for a high level of customization.
- **Capacity buffers.** By holding additional capacity and maintaining a significant amount of additional warehouse space, Zara creates the ability to react to known or unknown surges in demand. The additional warehouse space allows Zara to rapidly make and hold large amounts of product until it can be shipped to retail stores. Other examples of capacity buffers are those held by pharmaceutical companies to enable them to respond to competitive bid tenders and, in the service sector, most fire engines are on stand-by awaiting emergency call out. Companies that service strong seasonal demand, or where supply is seasonal such as certain foodstuffs like sugar beet processing and sweet corn canning, also deliberately hold excess capacity.

Agility misconception #2: Expediting is not agility

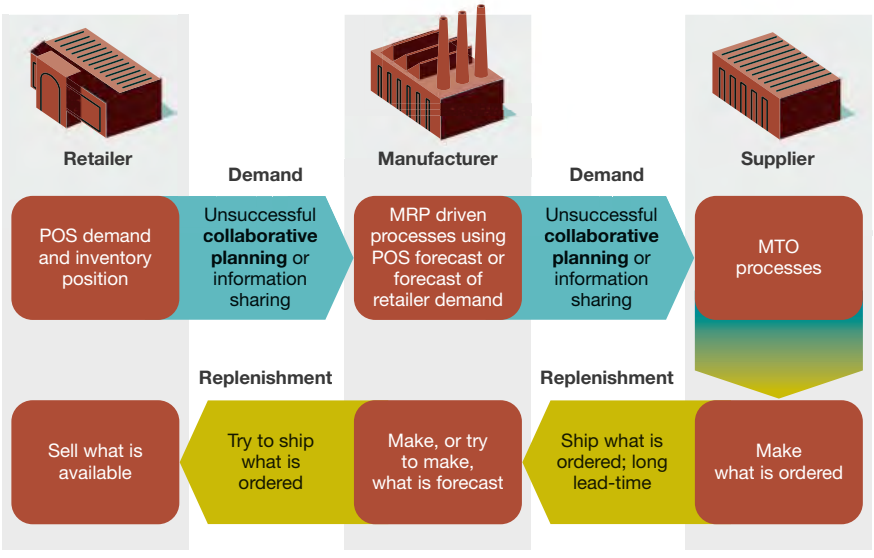
A second and more troubling misconception about agility can happen when manufacturers look at what organizations such as Zara, Dell and Cisco have achieved with their agile supply chains. Many manufacturers mistakenly think that agility is simply about being able to react quickly and successfully to unexpected demand. They may have some vague understanding that postponement is involved, but they believe that the use of time buffers in conjunction with a postponement-based approach is not relevant to them as they follow a make-to-stock (MTS) approach/strategy. Often under-appreciated is the fact that Zara has consciously developed a demand-driven supply chain strategy (and strategy is the key issue here) that is based around the principles of agility. This strategy utilizes elements of demand postponement (small initial commitments of sample products, followed by the quick manufacturing of more of what has sold—see sidebar "Demand postponement"); considerable spare capacity in its distribution centers; and careful positioning of time-based buffers, to create a world-class supply chain with "mind-spinningly supersonic delivery," as it was once described in the *New York Times*. These give Zara a significant competitive advantage in the apparel industry.

Demand postponement

Demand postponement is nothing new in the supply chain field. Use of a simple physical sampling approach allows manufacturers to understand which products are likely to have demand from their customers, or the end consumer. For example, Zara (and Benetton before them) issues small samples of its products to its retail stores and then, based on which of these products sell, quickly makes new units to replenish the sold products. By doing this, Zara predominantly makes products that customers want, and saves significant capital and inventory holding costs from making products that it would then have to significantly discount in order to sell.

FIGURE 3

Stage 1 agility: A misaligned supply chain



Source: Authors

Stage 1 Agility: Misaligned supply chains

Are other companies wrong to try to emulate what Zara does? No, but slavishly copying how Zara has configured its supply chain would be incorrect. Instead, they should apply the same conceptual principles (buffer selection, buffer positioning and buffer minimization) that would deliver competitive advantage in their marketplace. Zara, for instance, has elected to use a time buffer in assembly to enable quick responsiveness to changing fashions and have minimized it through using local suppliers. Other retailers may have chosen the same buffer but have used slow-response offshore suppliers with significantly less successful results.

The question then is: How can other manufacturers, particularly those that make-to-stock, succeed in creating an agile capability for their supply chains? The answer we suggest is that they start by applying the principles of Zara's approach at a tactical level, by moving from Stage 1 Agility (see Figure 3) to Stage 2 Agility (see Figure 4).

In Stage 1 we see that retailers may well share both point-of-sale (POS) demand and their inventory on-hand position with a manufacturer, possibly as part of an attempted collaborative planning relationship. At this point—and this is critical—the manufacturer creates its own forecast of demand, which it then uses, (i.e. forecast push) to drive its master production schedule (MPS) and materials requirements planning (MRP). As all forecasts are inevitably wrong (and the majority of SKU-level forecasts are invariably more than 40% wrong, even when overall forecast mix accuracy is excellent at, say, 80%), these forecast inaccuracies generate performance destroying supply chain variability that the manufacturer's suppliers often buffer using a long lead-time make-to-order (MTO) approach to fulfill their customer orders. This misaligned process typically results in excessive but unbalanced inventories, customer service issues, the heavy use of expedited shipments and much wasted capacity through unplanned supply schedule changeovers. These problems all arise from the inappropriate use of forecasts by manufacturers to drive their supply operations.

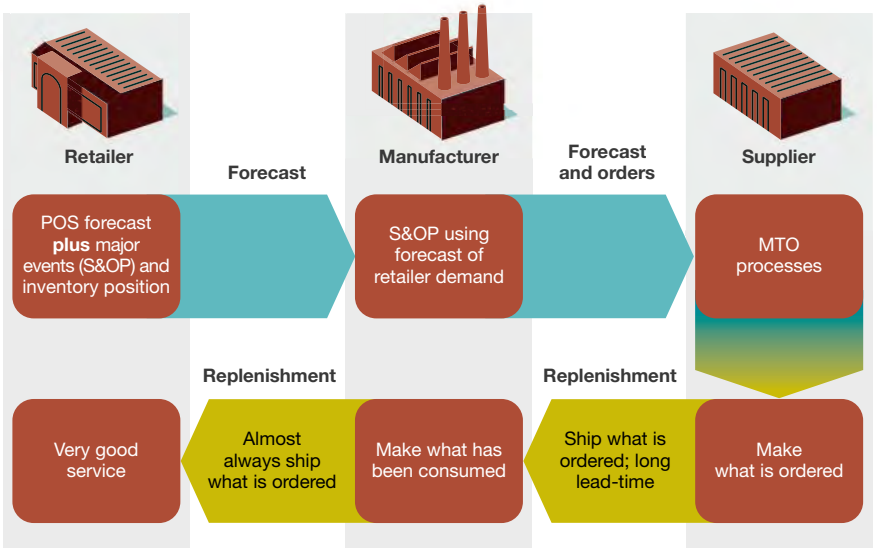
Stage 2 Agility: Internal supply chain agility

At a tactical level, a basic form of agility can be realized, although it takes on a different form from the kind of agility that Zara has achieved at the strategic level. Here the manufacturer simply makes only what has been sold to its retail customer instead of utilizing its traditional forecast-push replenishment approach (see Figure 4).

Making what has been consumed may appear to be an insignificant change, but it has some major performance impacts. At this point readers from make-to-stock manufacturers might be panicking and wonder: What happens to the forecasts that we are so utterly dependent on? For manufacturers that believe agility is about responding quickly to unexpected demand, the unexpected demand isn't actually unexpected—it's just different to the inevitably inaccurate forecast that is being erroneously used to create an inaccurate MPS.

FIGURE 4

Stage 2 agility: Internal supply chain agility



Source: Authors

All companies that use forecast driven MPS/MRP can become immensely more agile by positioning planned but independent/de-coupled/right-sized/maintained inventory buffers in the supply chain and using consumption-based pull replenishment for all day-to-day business, and anticipatory "push" for the management of major events such as strong seasonality and advertising campaigns.

Forecasts in a demand-driven or consumption-based supply chain are used for S&OP (capacity, inventory and financials planning), exceptional/extreme event management and sizing the inventory buffers, but not for directly driving a master production or distribution plan using traditional MRP logic.

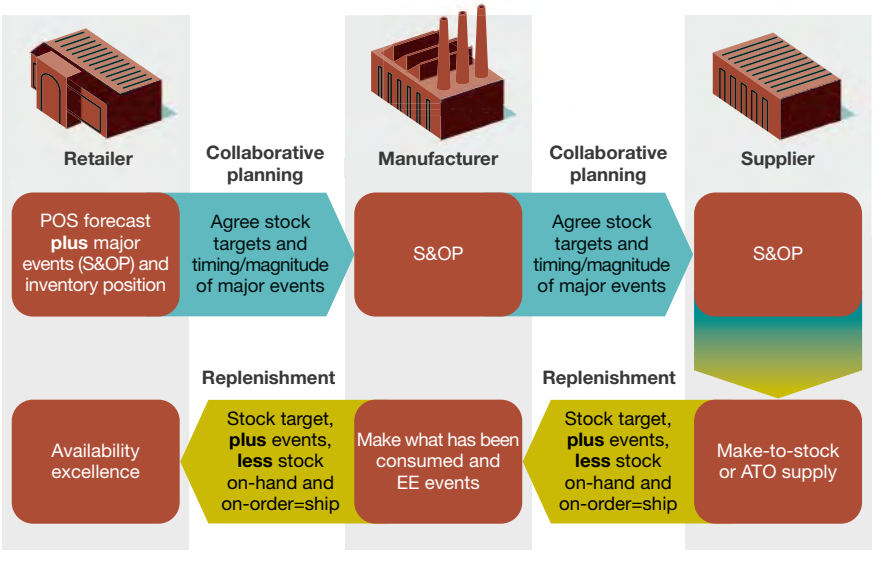
Stage 3 Agility: Extended demand-driven supply chains

With the fundamentals of internal supply chain agility in place (i.e. Stage 2 Agility), trading companies can then explore how such agility can be further developed through use of collaborative-pull replenishment (as opposed to the forecast-based CPFR that didn't work because it was a "push" process) with selected partners (see Figure 5).

As this form of collaboration matures and the manufacturer and retailer focus their attention upon buffer sizing and event management (i.e. running promotions) instead of continuous "fire-fighting," they will be able to reduce the size of their planned inventory buffers as point of sale consumption becomes the primary driver of end-to-end flow. And by achieving service excellence through such flow, the extended demand-driven supply chain can increase its throughput and capacity utilization with the shared benefit of lower cost and higher

FIGURE 5

Stage 3 agility: Extended demand-driven supply chains



Source: Authors

competitiveness. This is an example of where it is no longer the individual company in the supply chain that competes, but rather, it is the whole supply chain that competes with other supply chains.

A powerful example of this Stage 3 Agility emerged in the early 2000s in the UK. Nestle used a form of demand postponement, whereby it reduced its initial commitment for manufacturing promotional items, and by way of a collaborative planning approach with one of its largest customers, it captured real-time demand of promotional items and quickly manufactured small amounts to replenish against the promotional products that had been sold. Customer service levels were consistently higher than 99% combined with a significant reduction in finished goods inventory.

Stage 4 Agility: Extended supply chains with a dominant player

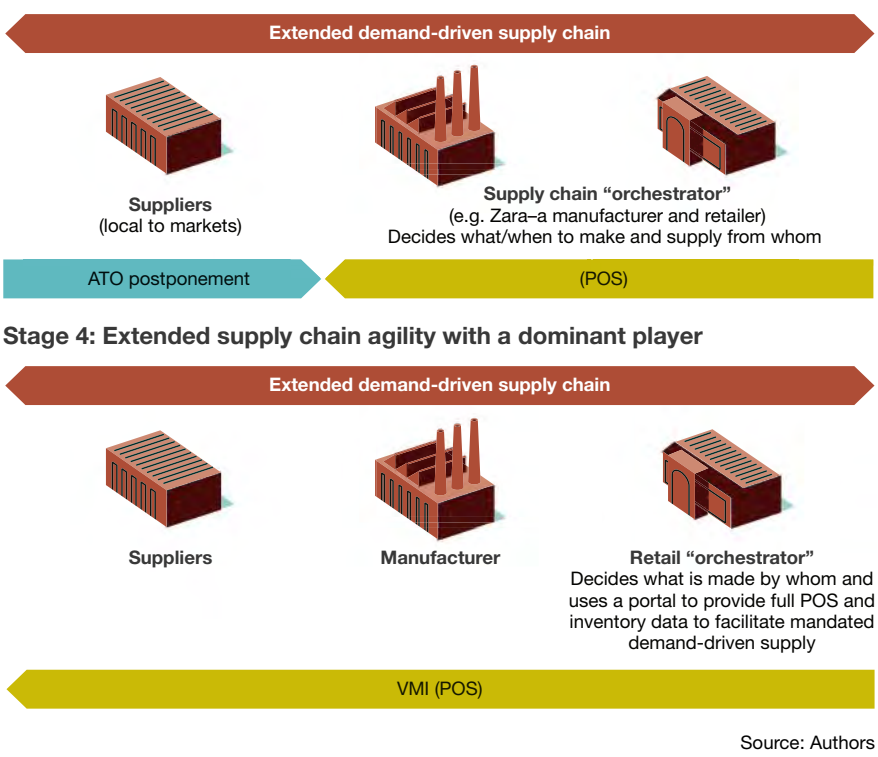
Figure 6 shows Stage 4 Agility, where the agility derived from the demand-driven extended supply chain can be further developed to provide a source of significant competitive advantage.

It is this competitive advantage that Zara, as the dominant player (or the "orchestrator" in the supply chain), has achieved in the apparel industry. (Though it should be noted that Zara is unique in that it is the product of the marriage between manufacturing and retailing.) Zara's entire make supply chain is consciously designed with agility in mind, using demand postponement, spare capacity in its distribution centers, the use of local suppliers and cross-functional design-make-distribute processes—all of which is driven by a continuous flow of close to real-time information about what products are selling and where. Zara also has a buy supply chain for products that do not readily fit the agile approach, such as leather-based products that by their very nature are heavily dependent on forecasts.

In Figure 6 we suggest that while it may not be possible for all organizations to achieve this strategic form of agility, there are other likely candidates, such as multiple grocery retailers, that could take on the role of orchestrator in their respective private label supply chains.

FIGURE 6

Stage 4 agility: Extended supply chain agility with a dominant player



Source: Authors

Agility is possible

Supply chain agility is possible, but a critical step toward its realization requires the abandonment of our initial perception of what we think agility means. While we all can observe what Zara has achieved with its agile supply chain and the creation of fast fashion, its ability to respond with blinding speed to changes in demand is misleading. As previously mentioned, Zara has achieved supply chain and market success by designing and operating a manufacturer-to-retail supply chain with

deliberately selected, but minimized, buffers that give it a real competitive advantage.

Manufacturers and distributors in other verticals may not be able to replicate Zara's model. But as we've demonstrated, virtually all companies can improve their agility and efficiency by understanding and implementing the principles of buffer minimization. Such internal agility can then form a foundation for the possible development of strategic buffer management (i.e. selection of the right buffer mix) to support competitive advantage such as Zara has achieved.

Case Studies

There are already some clear examples of manufacturers that have moved away from utilizing a forecast-push approach. Please note that in our examples below the corporate names have been changed. In the late 2000s, Lexitech Inc. experienced the benefits of becoming more agile (see mini case study No. 1). Flexcon Inc. switched from a forecast-push driven MRP-based planning approach to one that was demand driven, leading to improved inventory turnover, reduced finished goods inventory levels and improved customer service (see mini case study No. 2). And, Agilcon created a demand-driven MRP that significantly reduced order-cycle times, finished goods inventory levels and improved customer service (see mini case study No. 3).

Mini case study No.1. Lexitech Inc. makes heavy construction equipment and was operating two plants in the United States: Plant No. 1 ran on a forecast-push basis for its material requirements planning (MRP) and Plant No. 2 ran on a demand-driven (enterprise-wide pull) basis for its MRP. Following the global financial crisis of 2008-2009, Plant No. 1 saw its sales drop significantly, but found itself with over 18 months of inventory and, despite this high level of inventory, was still having to widely expedite orders being shipped to customers. Plant No. 2 saw its sales levels drop considerably too—but so too did its inventory levels. This was due to the agile capability that being demand-driven gave the plant and it was thus able to continue maintaining high customer service without expediting.

Mini case study No. 2. Flexcon Inc. is a UK-based award winning subsidiary of a large retail conglomerate, and manufacturers healthcare products. In 2006-2007, Flexcon began switching from an MRP-based planning approach to an enterprise-wide pull-based approach. In doing so, Flexcon reported doubling its inventory turns and improved its scheduling stability from 60% to 95%. Alongside this, the lead-time for in-house bottle blowing decreased from six weeks to one week combined with a 33% reduction of inventory. Flexcon also reported a 30% reduction in its finished goods levels. Following the complete transition to the enterprise-wide pull-based approach, Flexcon reported a further 20% reduction of finished goods. Overall lead-time reduced from 12 weeks to four weeks and internal service level improvement increased to 98.9%. The lead-time reduction coupled with the inventory reduction had a significant positive cash flow impact for Flexcon.

Mini case study No. 3. Agilcon Inc. is a global consumer packaged goods manufacturer. In the late 2000s, Agilicon began to experience production schedules that looked remotely like the demand patterns its retail customers were experiencing. Before it became demand driven, it was challenged by significant order-cycle times accompanied by frequent requests for expedited shipments. It made the decision to switch to a demand-driven MRP approach based on replenishing outgoing shipments that resulted in significantly shorter lead-times (down by 82% from 50 to nine days), less working capital requirements and significantly dampened bullwhip. Finished goods inventory dropped by over 45% with consistently maintained service levels of over 99.5%.

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The 2016 3PL CEO Survey:

Threats, Disruptions and Opportunities

The 3PL faces unprecedented challenges from e-commerce, Amazon and new technologies. But opportunities abound for those 3PLs that turn them into a competitive advantage.

Threats, disruptions and opportunities. This might sound slightly counter-intuitive, but it is an accurate description of the results of the 2016 survey of the CEOs of 14 of the largest third-party logistics (3PL) companies serving the North American marketplace, representing $19.8 billion in North American 3PL revenues during 2015.

This is the 23rd iteration of this annual study, and this year, we are taking a little different tack. Along with surveying CEOs on economic topics, which we will publish separately on scmr.com, we also looked into the dynamics driving changes in the marketplace; the threats they may present to the 3PL industry as well as the opportunities they present to those 3PLs that can turn potential disruptions into a competitive advantage. Those topics included recent shipper reactions to the 2014-2015 labor problems at West Coast ports, changes in the e-commerce marketplace and their impact on 3PLs, Amazon's continued expansion into logistics services, major technology changes affecting the 3PL industry and the growing use of data analytics by 3PLs.

BY ROBERT C. LIEB

E-commerce marketplace dynamics

E-commerce is an increasingly important revenue source for the 3PLs that participated in our 2016 survey, accounting for an average of 14.04% of their North American revenue base in 2015. That business grew by an average of 18.46% during that year. Given the growth potential of that market, these companies have substantially increased their resource commitments to developing and servicing e-commerce accounts.

Eleven CEOs noted significant changes in the North American e-commerce marketplace in the past year, reporting the following:

- continued explosive e-commerce growth;
- shorter delivery trips as same day/next day service offerings increased;
- increasing pressure on retailers to market-position inventory;
- the growth of e-commerce of heavier goods outpaced growth of package deliveries;
- "free returns" made handling returns a more significant problem for retailers and provided an opportunity for some 3PLs;
- Amazon and Walmart made massive e-commerce investments, with Walmart acquiring Jet.com to become more competitive with Amazon;
- pressure increased on retailers to develop omni-channel strategies;
- fulfillment services became more competitive with many new market entrants;
- more 3PL customer partnerships emerged to compete with Amazon;
- mobile engagement expanded with e-commerce customers;
- acquisitions enabled new approaches to last mile deliveries;
- and greater retailer emphasis was given to avoiding shortages/poor delivery services.

The dynamics of the e-commerce marketplace continue to change almost daily. Retailers, 3PLs, carriers, warehouse operators and others are constantly being challenged to develop new service offerings targeting this marketplace. They are massively increasing the resources committed to this market segment while steadily decreasing their commitment to physical stores. In my opinion, the risks associated with these strategies are increasing dramatically.

Major logistics challenges facing e-commerce customers

When the CEOs were asked to identify the major logistics challenges facing their e-commerce customers, they responded with the following eight challenges:

1. market positioning inventory to support shorter lead-times;
2. trying to compete with Amazon and Walmart in terms of facilities and services;
3. deciding whether to partner with or compete with Amazon;
4. attempting to meet steadily increasing customer service requirements at reasonable costs;
5. dealing with outdated systems and technology;
6. determining the appropriate threshold for implementation of technology and equipment to scale fulfillment operations;
7. attempting to reduce time-in-transit at reasonable costs; and
8. providing increased visibility to customer shipments.

The growth of e-commerce and its domination by several large companies is exerting constant pressure on other retailers to make such changes. Those changes are impossible for most small- to medium-sized retailers and are exerting enormous financial pressure on many of the largest retailers in North America. The failure rate in retailing is likely to increase dramatically and those failures won't be limited to smaller companies.

Major 3PL challenges in supporting e-commerce customers

Trying to meet the service requirements of their e-commerce customers poses major challenges to 3PLs. According to the CEOs, 3PLs must tailor their services to customer size. They must also finance technology upgrades, particularly with respect to competitive visibility technology. While doing so they must find capital to finance expansion of inbound-to-retail and sorting facilities.

3PLs must deliver the required speed to customers, but also push back on unrealistic customer demands. 3PLs need to cope with seasonal spikes in demand that intensify staffing and transportation issues. In trying to be market responsive, many 3PLs must also overcome significant internal institutional inertia. To put it mildly, this is a formidable list of requirements for 3PLs to meet if they are going to retain and grow this business. In many instances, the margins on this business are quite low and that leads to considerable internal debate within 3PLs about the wisdom of continuing to make large-scale investments in this market segment.

Amazon's impact on the e-commerce marketplace

The data generated in our last several North American surveys clearly show Amazon's actions not only impact the e-commerce space, but also the 3PL industry. In our annual update on the "Amazon Effect," this year we asked if Amazon's actions in the past year had caused any significant changes in the North American 3PL marketplace. Nine CEOs said "yes." One of those changes involved Amazon as a heavy user of 3PL services between November and January. Without that business, some 3PL capacity might not have been utilized. Amazon also continued to constantly increase customer service level expectations while exerting considerable pricing and delivery pressure on the 3PLs and parcel delivery services it uses.

In some instances, Amazon's actions have created new business opportunities for 3PLs. Amazon has recently moved aggressively into e-commerce of heavier goods and, in some instances, has used 3PLs to move those products. Another 3PL opportunity might also be traced to Amazon's actions. Few retailers have the space, distribution center technology and systems utilized by Amazon; as a result, those retailers often use 3PL services to keep up with Amazon.

All told, 10 of the 14 CEOs involved in the survey already consider Amazon to be a 3PL and eight of them see the company as a serious competitive threat.

Another aspect of Amazon's impact on the 3PL marketplace focuses on Amazon as a competitor. All told, 10 of the 14 CEOs involved in the survey already consider Amazon to be a 3PL and eight of them see the company as a serious competitive threat.

During the past year, Amazon made several transportation-related moves including leasing aircraft, obtaining a freight forwarding license in China, introducing a branded trailer fleet and acquiring a European delivery company. The CEOs were asked what impact, if any, those moves would have on the 3PL marketplace. Three said that it was too early to ascertain those impacts, while two viewed those transactions as simple vertical integration. Others saw those moves as giving Amazon greater control of its supply chain and allowing it to foster faster delivery times, particularly during the holiday season. It was also suggested this would allow Amazon to offer complete solutions to some customers and that might increase its market share of time sensitive shipments.

One respondent suggested that as Amazon increases its network capacity it will attempt to promote more efficient asset utilization by offering more extensive transportation and logistics services to other companies. I identified these possibilities several years ago, and believe that for 3PLs and parcel delivery companies to ignore (or treat as trivial) the likelihood of an expanded role for Amazon in the logistics services and transportation markets is an enormous strategic mistake.

The Uber platform

The original Uber business model has been very successful in many markets around the world. In commenting on the findings of our 2015 survey, the authors suggested it was very likely that Uber's platform would also be used in a parcel delivery capacity—and that is now happening.

The fulfillment sector of the e-commerce marketplace is becoming increasingly crowded and extremely price competitive. Many new entrants are technology-driven and use technology as a means of market differentiation.

In responding to our 2016 survey, five CEOs indicated they have seen evidence that Uber is becoming a player in the last mile parcel delivery market, and that its shared/part-time capacity model might be better at those deliveries in some cases than more costly models. It was also suggested that Uber's aggressive use of technology could disrupt older models/sectors of the transportation industries, and that its focus on customer demand for real-time visibility and communication/interaction with the driver could be brought into freight markets. It should also be noted that in December 2016, Amazon announced it was considering the launch of an Uber-like application that might be applied to freight markets.

Echoing the experience of the pre dot.com collapse, the fulfillment sector of the e-commerce marketplace is becoming increasingly crowded and extremely price competitive. Many new entrants are technology-driven and use technology as a means of market differentiation.

Technology

The past several years have witnessed a proliferation of advanced technology applications in the 3PL industry. These applications have not only promoted greater efficiency, but also, in some cases, have provided a means by which 3PLs might differentiate themselves from their competitors. In recognition of these developments, we included a number of technology-focused questions in this year's survey.

Significant technology developments in the 3PL industry. The CEOs were asked to identify the three most significant technology developments in the 3PL industry in the past three years. Not surprisingly their responses included a wide variety of technology applications. Improved visibility technology received the greatest number of mentions with five. Mobile applications and the expanded use of data analytics were each mentioned three times. The growth of Cloud-based solutions, driverless vehicles, digital freight matching services and improved TMS systems were each mentioned twice. Among the other significant technology developments mentioned once were robotics applications, enhanced warehouse automation, improved Customs clearance technology, the Internet of Things, new e-commerce fulfillment models and improved global WMS systems.

Our previous surveys have clearly documented that 3PL customers often want the latest technology from their logistics service providers but are reluctant to see the costs of those technology upgrades reflected in the price charged by their logistics service providers. There are no indications that mindset is changing.

3D printing. Much media attention has been paid to 3D printing during the past several years, so this year's survey explored the extent to which that technology has affected the 3PL customer base in North America. Four 3PLs reported some of their customers were using the technology on a very limited basis, but none indicated those applications had affected the logistics service requirements of those customers. Interestingly, two 3PLs reported that they are currently offering limited 3D printing services to some customers.

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3D printing has great potential in terms of replacement parts for utilities and manufacturers. Instead of expediting a shipment for a part that is holding up production or causing an outage, the company can make the part on site.

Those surveyed were also asked how 3D printing might have an impact on the demand for 3PL services in the longer term. Their responses ranged from "minimal" to "the sky is the limit," with several respondents indicating the impact might be quite significant. Their observations are summarized below.

1. 3D printing will grow and provide customers with the ability to reduce their inventory of obsolete parts because parts can be printed as needed.
2. Ultimately it could reduce the overall demand for logistics services.
3. It might lead to shorter lengths of haul and more regionalized production.
4. It will mainly affect small volume, higher-priced items that can be made where and when needed. 3PLs that service those types of items today may see that as a competitive threat.
5. Supply chain structures, strategies and planning activities will change in a significant way requiring 3PLs to modify their solution design, planning and execution activities accordingly.
6. Inventory levels may be reduced and 3D printing may occur at 3PL facilities.
7. 3D printing has great potential application in the low velocity parts business.
8. Inventory will shrink in 3PL supply chains but this will provide opportunities for those that can bundle a 3D printing component with traditional 3PL service offerings.
9. It will shorten many supply chains but not reduce the need for supply chain services.
10. It has great potential in terms of replacement parts for utilities and manufacturers. Instead of expediting a shipment for a part that is holding up production or causing an outage, the company can make the part on site.

West Coast port issues

In our 2015 survey, we addressed the labor disputes involving West Coast ports and their impact on shippers, ocean carriers and 3PLs. At that time, we asked the 3PL CEOs if those problems had affected any of their key customers and 13 of 15 said "yes." Those customers had experienced long delays, re-routing of many shipments, shipments being stuck in ports, frequent shifts to air cargo at dramatically higher costs, longer transit times and many angry customers. All of the CEOs reported that their companies had taken steps to alleviate/prevent such problems for key customers.

They were then asked if they believed because of those problems some key customers were likely to significantly change their future supply chain patterns to rely less heavily upon those ports. Seven of 15 CEOs said such changes were likely.

We followed up on that issue in our 2016 survey. Eleven of the 14 respondents reported some of their key customers *had* changed their port strategies. Among the changes reported were:

- many customers had diversified their port strategies and were using more ports;
- six CEOs reported some customers began to specify moves through East Coast ports (two mentioned Panama Canal expansion as facilitating those shifts); and
- among the other changes cited were some shift from ocean to air freight, movement of freight through Houston, shipping to the West Coast of Mexico and Canada, using Prince Rupert, Canada as a port of entry, shifting more sourcing and manufacturing to Mexico and working with 3PLs to develop port contingency strategies.

It is now very clear that such disruptions and their related costs to shippers can lead to significant changes in supply chain planning in the shipper community and there are potentially longer-term impacts on ports, ocean carriers and labor requirements at affected ports.

Some companies, such as GE, are investing heavily in 3D printing and believe it will revolutionize manufacturing. That may be the case in the long term, but that is not going to happen quickly and the impact of 3D printing on the 3PL industry will be quite limited in the near term.

Big Data and data analytics. The use of Big Data and data analytics is becoming increasingly important to companies in many industries in their efforts to control costs, improve services and more effectively meet the needs of their existing and potential customers. In this year's survey, we asked the CEOs if their companies were currently using Big Data/data analytics tools and 11 (79%) answered that they were. They were then asked to discuss their most important applications of those tools to date. Their responses included:

- promoting supply chain visibility and optimization;
- examining customer attributes/attractiveness;
- developing pricing strategies;
- matching freight to capacity;
- supporting network modeling/utilization;
- analyzing demand management for customers;
- understanding supply/demand dynamics in different markets at different times;
- providing global commercial and operational data to customers;
- planning labor utilization;
- visualizing performance and product/order/shipment status data to provide insights to customers; and
- helping customers identify ways to improve their processes.

This is just the beginning and more creative and extensive use of Big Data and data analytics in the 3PL industry offers enormous potential for cost and service improvements in the industry.

More creative and extensive use of Big Data and data analytics in the 3PL industry offers enormous potential for cost and service improvements in the industry.

Political uncertainties abound

We have entered unchartered economic and political territory with the election of Donald Trump as President of the United States. Because very little specific attention was given to public policy and economic issues during the presidential campaign, there are great uncertainties moving forward.

The economic implications to the 3PL industry in North America are unclear. However, consider his proposal to change or dismantle the North American Free Trade Agreement (NAFTA). Trump has called NAFTA the worst trade agreement in history and the mere threat of significantly changing that agreement, at least temporarily, decreases the attractiveness of Mexico as both a near-shoring destination and a growth opportunity for 3PLs. This comes after several years in which many of the companies involved in our CEO surveys have made substantial investments to not only expand their cross-border services but also to grow their business in Mexico. The Trump Administration's continuing discussion of possible use of border taxes fails to acknowledge the likelihood of reciprocal actions by other countries and the impact that situation would have not only on import/export volumes, but also upon the foreign market access of U.S. companies. In such a scenario millions of U.S. jobs in export-related industries would also be jeopardized.

Hopefully, in the near future, discussion of free trade issues in Washington will begin to reflect at least a basic understanding of global economics; that would be a good starting point from which to consider the desirability of changes in U.S. policies in this field.

3PLs and terrorism

The recent wave of terrorist attacks around the world has demonstrated how vulnerable everyone is—and that without a doubt applies to supply chains. We asked the CEOs how significant the threat of terrorism has been to the planning processes of their companies. Two said "very significant," three said "significant" and nine said "not significant." Nine companies indicated that their companies have addressed related risks in formal business continuity plans. Six reported that their companies have taken a variety of physical and cyber security steps to address those issues.

In response to a question concerning the significance of the threat of terrorism to their customer base, seven answered "significant" and the same number answered "not significant." When asked if there were particular industries that have been more affected than others, five said "yes" and they listed the grocery/food, health care, cross-border freight forwarding, retail, and utility/energy industries. Four respondents indicated some customers have asked them for assistance in reducing the vulnerability of their supply chains to terrorist acts.

It is puzzling to see that some large 3PLs do not see this issue as significant and have failed to reflect their potential exposure in business continuity plans. Failure to be prepared to handle such circumstances, should they arise, can have catastrophic consequences. The increasing use of trucks as terrorist weapons should act as a wake-up call.

3PL selling upstream

We've discussed the potential of 3PLs selling upstream in customer supply chains on numerous occasions throughout the years, and decided to address the issue again in our 2016 survey. Those surveyed were asked if their companies had utilized that strategy, and 10 CEOs (71%) said that they had. They were then asked to briefly discuss the effectiveness of that strategy, and their eight responses are shown below.

1. This strategy has fueled our growth and our diverse product offerings provide customers with "one-stop" solutions.
2. "C" office involvement is a key requirement for adopting this strategy.
3. This strategy has worked very well. We now provide more services to customers and that makes the relationships more sticky and meaningful.
4. We have many customers who are suppliers to some of our other customers.
5. This strategy has resulted in additional competitive differentiation for us and expanded our business opportunities.
6. Increasingly customers are interested in taking more of an end-to-end view, and making more strategic, holistic assessments.
7. This strategy is not without challenges, but we believe bundling strong capabilities along customer supply chains provides better growth opportunities for us.
8. With our technologies, we are able to integrate with customer ERPs and provide data and visibility to help customers make decisions further upstream. We now provide additional value-added services to customers to extend our service offerings.

Any existing or potential customers that are serious about supply chain integration would seem to be viable targets to approach about such integrated 3PL services.

Observations and implications

There are implications to the industry from each of the topics discussed above. Let's start with e-commerce, where respondents reported that their e-commerce revenues grew by an average of 18.46% during the past year.

This is not the first time we have seen such 3PL optimism related to e-commerce. Before the original dot.com bubble burst many large 3PLs involved in our annual survey had created separate e-commerce business units and grew their e-commerce business at impressive rates. The CEOs also typically ranked the growth of e-commerce as not only one of the most important industry dynamics, but also one of the industry's greatest opportunities. When the bubble burst,

many 3PL e-commerce customers went bankrupt owing substantial sums to 3PLs. At that time, the reaction of many 3PL CEOs was "we'll never make that mistake again," or, "maybe we'll serve B2B customers in the future, but we will never handle B2C business again."

Before that crash I had suggested that simply putting an "e" in the front of a company name didn't guarantee that the company would be either a viable business enterprise or an attractive 3PL customer. I'd like to make the same observation again. There is a familiar echo in the marketplace of free shipping and free returns. Neither are free; someone has to absorb those costs. Amazon and others have continuously increased customer service level expectations while failing to charge real prices for those services. While that is taking place, Amazon and other e-commerce companies are attempting to offload at least some of the related problems on 3PLs and parcel delivery companies by squeezing them on prices. Obviously, that is not a sustainable practice. Amazon also continues to build out its own logistics capabilities and is expanding into its own physical stores. The company has not only opened bookstores and convenience stores, but also recently announced plans to open 2,000 grocery stores with automated check-out processes.

Oil prices are well below their peak. Interest rates are at record lows and that makes stockpiling inventory in the marketplace to support same day/next day deliveries feasible. Should oil prices and interest rates rise substantially that would lead to very interesting dynamics in the e-commerce marketplace. Even a company like Amazon that cross-subsidizes its retail operations with profits from its Cloud services business would have a difficult time absorbing those additional costs, and would likely attempt to increase the prices of Prime and other related services. Alternatively, Amazon could attempt to pass those additional costs through to customers in the form of higher prices. That would likely be met with substantial customer resistance that would jeopardize the future growth of e-commerce. In a worst-case scenario, those developments would be accompanied by a global recession.

Technology is changing rapidly in the 3PL marketplace and many companies are hard pressed to find the capital necessary to finance upgraded systems to remain competitive. Those that can will increasingly use technology as a means of market differentiation in an industry that lives in fear of the growing commoditization of 3PL services.

The use of Big Data and data analytics is steadily increasing in the 3PL industry and offers real promise in terms of not only reducing costs and improving services, but also in terms of understanding true marketplace dynamics.

The North American 3PL marketplace is changing at an unprecedented rate. The issues discussed above, coupled with the current uncertain political environment will certainly make 2017 a very challenging year for large 3PLs. Developing strategies that reflect both the risks and rewards in this marketplace will not be an easy task.

3PLs participating in the *2016 North American 3PL CEO Survey*

- Agility Logistics
- APL Logistics
- Cardinal Logistics
- Coyote Logistics
- DHL Supply Chain
- DSC Logistics
- MIQ Logistics
- Nippon Express
- Transplace
- UPS Supply Chain Solutions
- Werner Logistics
- XPO
- Yusen Logistics
- Name kept confidential

America first: Changing the rules of the supply chain game

There's a new supply chain game in town and the rules are not widely understood.

By Pramod Gupta

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"For the first time since the end of the Second World War, the future relationship of America to the world is not fully settled."
—Henry Kissinger, The Atlantic, December 2016

There's a new supply chain game in town. The rules of this new game are not widely understood, but the purpose couldn't be clearer: America first. President Trump has vowed to put the interests of America and the American worker "first" in fashioning his trade and foreign policy.

For seven decades, both Republican and Democratic administrations embraced the notion that an internationalist foreign policy and a global trade strategy would create domestic prosperity and bind nations together in global harmony. Today, critics of this "old game" say our current pro-trade foreign policy has caused irreparable harm to America's economic interests, and, in particular, to American workers and the domestic economy. American jobs have disappeared and plants have either moved abroad or closed due to foreign imports. Manufacturing jobs between 1990 and 2015 dropped from 18 million to 12 million. There is no question that manufacturing efficiency and automation played a large role in these trends, but the political reality of lost jobs and decimated towns across America has subordinated global trade to the needs of the American worker. The new administration in its first trade manifesto states, "it will take a zero-sum approach—with every negotiation starting from the basis of how American workers will be helped."

Learning the new rules

All companies are now faced with a new playing field, new players and few guidelines. Historical precedents are not readily available for what appears to be a massive reversal of global trade policy. With most medium and large companies operating on a global scale, the first question on everyone's mind is what is the best manufacturing and supply chain strategy given the shifting winds of potential new government policies; particularly, those around trade and regulations. Should we proceed or hold on off-shoring plans? Should we move to quickly re-shore manufacturing activity? Will there be levies on our global suppliers, or tariffs on goods made in offshore facilities, and how will that affect our competitiveness?

A.T. Kearney contends that companies must consider both short-term and long-term options. No one really knows how new trade policies and actions will affect the economy and trade relations with other countries. Initially, it appears that the rhetoric and activity is designed to prevent American companies from moving offshore, but that alone may not be enough to significantly grow the economy or fully deliver on campaign promises. If the actions of the

last few weeks are any indication, any decision that appears to negatively affect American workers will face pushback by the administration. Complicated, nuanced solutions will be superseded by simpler ones—even if they have negative consequences.

Overall risk analysis must not only comprehend the straightforward operational and financial issues of closing or relocating a plant, but also prepare for the bolder negotiating stance of labor unions. In addition, there will be new political risks as well as the possibility of consumer backlash. The C-suite must now elevate strategic decision making from the traditional analytical exercise of evaluating factor costs arbitrage (labor, utilities, logistics etc.) to a more "trade-game-theory" and "scenario planning" exercise. Here, we discuss options from an operational perspective. In future articles, we will more fully explore trade-game-theory and scenario planning.

Companies that are in the process of moving production (or supply source) offshore, or are contemplating off-shoring in the next six to 12 months, must reevaluate their business case. We believe that companies must reconsider all options again—especially their next best option(s)—whether that is leveraging in-country contract manufacturing or in-country manufacturing (or source of supply) options. This review must be end-to-end. Delaying impending network transitions may be the prudent choice for now. Companies must also consider delaying full decommissioning of "closed" plant assets; perhaps even operate them at a reduced scale. Should the next best option not be available, companies must bring in reinforcements to broker a win-win solution with government agencies.

Long-term options should benefit from clearer policy "rules of the game" as direction on the future corporate tax rate, incentives for domestic manufacturing, renegotiated trade agreements or reciprocity requirements for foreign investments are clarified. In anticipation, companies should immediately begin to investigate alternatives to deliver on the shareholder promise. This may range from redirecting their planning efforts toward regional supply chain reconfiguration, considering investing in advantaged assets (and offset high labor costs) in the United States and committing resources toward four-wall plant improvements and other supply chain improvements.

Playing the new game

Companies are in business to make a profit. No profit equals no business and no jobs for American workers. As global companies begin to evaluate their supply chains and adjust their strategies to "play" in today's environment, they should measure their networks on the three qualities that Hau L. Lee, professor of operations at Stanford University, identified in a 2004 Harvard Business Review article as qualities of top-performing supply chains.

The C-suite must now elevate strategic decision making from the traditional analytical exercise of evaluating factor costs arbitrage (labor, utilities, logistics etc.) to a more "trade-game-theory" and "scenario planning" exercise.

Agility. Supply chains become a competitive differentiator when they react swiftly to sudden changes in demand or supply using enhanced capabilities.

Adaptability. Networks evolve over time as market structures and strategies change through technological advances as well as potential new ways to produce, partner, sell and deliver goods and services.

Alignment. Collaboration between all of the firms in the supply network optimizes the chain's performance and maximizes profits in new environments.

Many global companies have already launched internal efforts to explore alternative supply chain strategic options to drive profitability and success. Solutions are being designed to leverage company strengths while addressing the inherent challenges and unknowns of the current political environment. It is imperative that companies assess all of their options, proactively evaluate scenarios and identify both near-term and longer-term strategies to win this new supply chain game.

EXECUTIVE INSIGHTS

The following Executive Insights provide supply chain acumen from top-level company executives. They identify trends and market intelligence that will improve the performance of your company's supply chain—while keeping costs in check.

SUPPLY CHAIN MANAGEMENT REVIEW

EXECUTIVE INSIGHTS

Four Logistics Trends to Watch in 2017

Q&A with **Dennis Anderson**, Chief Customer Experience Officer, ArcBest®

Q: How is e-commerce affecting supply chain management?

A: E-commerce is causing structural changes to supply chains with intense focus on delivering what consumers want, how and when they want it. Many retailers and vendors are creating more regional distribution models and shipping in smaller quantities. The need for delivery options is also expanding. It can be difficult to find a provider that can reliably deliver to peoples' homes within a small timeframe. Through our U-Pack® business and final-mile solutions, ArcBest has 20 years of experience with residential deliveries. We are well-equipped to handle the increased logistical demands that e-commerce brings.

Q: How can the rise of data analytics aid shippers?

A: Data and analytics can change the game if a shipper responds to uncovered trends. Most shippers are looking to increase their analytics capabilities to help drive supply chain decision-making in terms of provider selection, supply chain design and/or fulfillment strategy. A strong strategic supply chain partner like ArcBest can help with leveraging analytics to uncover trends, then address them with integrated logistics solutions. We can leverage our decades of expertise in areas such as less-than-truckload (LTL), truckload (TL), ground expedite and time-critical shipping, or supply chain optimization.

Q: Will the electronic logging device (ELD) mandate affect U.S. trucking capacity?

A: Carriers and drivers that use paper logs or logging software to record their hours of service are required to be using ELDs by December 18, 2017. The effects of the mandate are something to watch, as it could affect millions in the industry.

Many experts believe that it will take perhaps a significant portion of trucking capacity out of the market as some drivers or carriers decide to leave the industry rather than comply with the mandate. The only real points of debate among industry watchers are how painful the disruption will be and when it will occur. At ArcBest, we adopted this technology ahead of the mandate. Our entire Panther Premium Logistics® fleet has leveraged ELDs for years, and we've nearly completed installation of ELDs in the road and city tractors of our LTL carrier ABF Freight®. Savvy shippers will seek deeper relationships with compliant transportation partners ahead of the mandate to dampen the impact of any capacity tightness on their supply chains.

Q: What are shippers seeking as their own logistics needs change?

A: Change is constant, and the complexity and continued evolution of supply chains reflect this. Shippers want expert logistics solutions, partners they can trust, up-to-date technology, reasonable prices and value for their money. They want a reliable and excellent experience. At ArcBest, we are well aligned to handle supply chain challenges seamlessly through an expanded set of logistics solutions. We have guaranteed capacity, we continue to make investments in technology, and we have remarkable people who build exceptional strategic partnerships. The supply chain business is not for the faint of heart, but strategic partnerships with a provider like ArcBest can help shippers navigate its increasing complexity.

EXECUTIVE INSIGHTS

Using Technology to Bridge the Final Mile Logistics Gap

Q&A with **Eric St. Amand**, Vice President, Americas, Geodis

Q: Why is the final mile such a crucial link in the modern day supply chain?

A: First off, the final mile is client facing—it's an intimacy that will have an immediate impact (positive or negative) to your brand and product. The final mile is literally the last piece of the supply chain. If you think about global supply chains holistically, from raw materials to manufacturer to your customer's customer, successful final mile execution ensures a very happy ending to a long story. Keep in mind that final mile deliveries can make up nearly 30% of total delivery costs. So, final mile is important both in terms of finance and client satisfaction.

Q: Where do companies go wrong with their final mile logistics?

A: Final mile is a key component for all supply chains, for all products. You'd be mistaken to only attribute the importance of final mille to e-commerce. While B2C has accelerated innovation in final mile technology, anyone in the B2B space would be wise to pay attention. Shippers need to anticipate changing customer expectations; customers who use

Uber or receive product same day/within hours as a consumer will undoubtedly, in time, have the same expectations in the B2B world.

Q: What strategies should companies be using to avoid these final-mile logistics missteps?

A: Companies can overcome pitfalls by proactively understanding their final mile flows, processes and the rapidly changing technology in the last mile. Successful final mile execution is bigger than on-time and damage-free shipments. To do it right, companies need agility in their supply chain. From real-time visibility to expanding capacity through crowd sourcing, companies should demand this type of innovation from their logistics providers. It's one of the major reasons that we, at Geodis, decided to collaborate with Kanga (an Atlanta technology start-up). Kanga compliments our end-to-end visibility solution, GeoFlow, by enhancing the final mile experience and providing our customers flexibility to respond to a dynamic marketplace.

Q: What benefits can companies expect if they optimize their final-mile logistics?

A: Last mile optimization can benefit companies through cost savings (both in transportation and inventory optimization) and maintaining satisfied, loyal customers. Agile final mile solutions also help companies overcome logistical constraints in mega-cities. Supply chains will continue to be complex and fragmented; companies that have the foresight to optimize final mile will undoubtedly capture a competitive advantage now and in the future.

EXECUTIVE INSIGHTS

Major Shifts in Store for the Procurement Profession—Are You Ready?

Q&A with **Tom Derry**, CEO, Institute of Supply Management®

Q: How is the procurement profession changing right now?

A: Not surprisingly, over the past decade there have been some prominent shifts in the skills and knowledge required for a successful career in procurement, and that's because both the job role and job description are changing. For example, our data reveals a big demand for people who have higher-tuned analytical skills. People need to be able to use data to understand what's happening in their supply chains and that wasn't true 10 years ago.

Q: Can you give us an example of a key shift that buyers should be thinking about?

A: Sure. I would say sales and operation planning (S&OP) would be one area of particular interest. And while it's true that S&OP has become a central process in procurement today, this wasn't the case just 10 years ago. Also, it's important to note that most people today believe that a sophisticated category management strategy is a part of most large organizations' supply chain approach. However, the reality is that the practicing professional doesn't always have a well-honed sense of what it takes to be an effective category manager. If someone hasn't built that they capability, it could hinder his or her ability to advance in the profession.

Q: How did ISM arrive at these conclusions?

A: As part of a refresh of ISM's certification program, professionals go through a formal quantitative research process called the "job task analysis." Through this process, we collected more than 700,000 data points from 2,600 practitioners in 50 countries. Then we conducted a very rigorous analysis on those numbers.

Q: Can you share any other data points with us?

A: The job task analysis revealed that applied analytics is now a must-have skill. The research specifically identified requirements for skills in data mining, data visualization, artificial intelligence and cognitive procurement, among others.

Q: What is ISM doing to help bridge some, or all, of these gaps?

A: We help practitioners who may be working in supply chain day in and day out, and who tend to become focused on their own organization, their own company's objectives, the industry they work in and their competitive environment. These individuals tend to have a point of view on supply chain that reflects that perspective. By its very nature, ISM works across more than 36 industries in both the services sector and the manufacturing sector. We have a broader perspective on the changing mix of skills. If you're in pharmaceutical or automotive or financial services, for example, you'll probably know your own professional space but you won't necessarily be aware of emerging best practices that might apply to your situation. We help to bridge those gaps and cultivate practitioners who are well equipped to tackle the new challenges of procurement and supply chain.

EXECUTIVE INSIGHTS

Three Trends Affecting Logistics Management and Supply Chain

Q&A with **Shannon Vaillancourt**, President, RateLinx

Q: What macro trends are currently affecting logistics management and supply chain and why are they important?

A: There are several macro trends that are affecting logistics and supply chain management. There are three that deserve the most focus: 1) technology; 2) visibility; and 3) complexity. These issues are important because today's logistics and supply chains are much more complex than they used to be. Many of these complexities are caused by the globalization that has occurred due to emerging markets providing a way for many companies to grow. Now you have products that could be moving around the globe using many different modes to complete each leg of their journey to the consumer.

Q: What's driving these trends?

A: The Amazon influence is requiring that companies provide visibility to their customer along with their staff to ensure that there are no disruptions in the products' journey. The consumer wants a variety of products in a very short time and they want to be able to know where they are at every step of the process. That's why technology is becoming more and more important. The only way to manage the complexities and deliver the visibility at the speed the consumer demands is with a technology platform that

is plugged into all of these modes around the globe. Just think, you can order a pizza from Domino's and their system will alert you when it was placed in the oven, and continue to alert you until it's delivered. This is what consumers and businesses are starting to expect with everything.

Q: Where does Big Data come into the picture?

A: Big Data affects these trends through the new software tools available today that can capture the volume of data, integrate the variety of data, at the velocity the consumer is demanding, with the veracity that is required. RateLinx' Intelligent Invoice ManagementSM (IIM) was created to help companies deal effectively with the four "Vs" of data: volume, variety, velocity and veracity. It pulls all this data together in an easy to understand view that tells the shipper and the consumer where their products are. IIM starts by capturing the data from the current data sources a company has, thus allowing the firm to utilize the RateLinx Enterprise solution to augment their current environment to plug the holes that may exist. It doesn't require that a company rip out its current systems, like TMS, in order to gain the benefits of the RateLinx Enterprise solution.

Q: What's coming around the next corner for supply chain managers?

A: The upcoming trends concern increasingly leveraging technology to provide predictive analytics. Instead of waiting for a carrier to notify you that the shipment is going to be delayed because the freight was stuck in bad weather, for example, technology will tell you that the shipment will be delayed because a storm is going to cross the path of the freight in two days. This type of artificial intelligence will help companies be more proactive which in turn will result in better customer service and definitely provide a competitive edge.

Carrier Liability is Not Insurance

Q&A with **Dave Zamzky**, Vice President of Marketing, UPS Capital

Q: What is carrier liability?

A: Let's start with what carrier liability is not. Carrier liability is not insurance.

Carrier liability is typically a nominal amount that may be recovered against carriers in the event of goods being damaged or lost while in transit. Applicable law and/or industry standard, which vary by mode and region, will usually determine a default maximum liability of the carrier, for example between $0.50 and $5 per pound on domestic ground shipments. However, greater liability limits may also be purchased for an additional charge. It is important to note that such increased liability, or "declared value" liability, is still a form of carrier liability and is not insurance.

Q: What should companies know about the limitations of carrier liability?

A: Generally, for the shipper to recover on a claim, the shipper—not the carrier—must prove, at the shipper's expense:

1. that the goods were in good condition when given to the carrier;
2. that the goods were already damaged when delivered (or not delivered at all);
3. the amount of the damage; and
4. that any defenses asserted by the carrier do not apply.

Even if the shipper is successful proving the above, the carrier's liability is still limited to the carrier's liability limitation, the declared value amount, or the replacement cost at destination. This can be a far cry from the sale price of the goods.

Q: Why is this important for companies to keep in mind?

A: Companies are putting themselves at risk if they assume that carriers' contractual terms and liability laws help "insure" their shipments. Again, carrier liability is not insurance. The laws and their interpretation can be different, depending on the mode of transport, and can be complex.

Q: Can you give us an example of how carrier liability works?

A: A truck carrying a pallet of smartphones is hijacked. Each phone is worth $300, and each of the eight boxes weighs 50 lbs. That's 400 pounds of smartphones worth $480,000. Typical carrier liability for smartphones is generally around $10/lb., so the shipper would be reimbursed $4,000 (400 lbs. x $10/lb.). The shipper is out $476,000. Now, the shipper could have purchased declared value liability to try and cover the goods for the $480,000; however, they would need to confirm the cost, make sure there are no carrier liability defenses and prepare to do battle should a loss or damage occur. I know this is an extreme example, but what is really staggering is the amount of new sales required to offset that loss. If the company had a 6% profit margin, they would have to generate $8 million in new sales to cover that loss.

Q: How can companies avoid these challenges?

A: Shippers can avoid these issues by having a cargo insurance policy. Most people have insurance—for their home, their health and their autos. But most don't think about insurance for supply chain loss. That can be disastrous and in some cases put a company out of business.

A SPECIAL SUPPLEMENT TO
SUPPLY CHAIN MANAGEMENT REVIEW

$upply chain finance trend$

Unlocking the hidden financial value in a global supply chain isn't always easy, but the opportunity exists for companies that want to work together for the greater good.

BY BRIDGET McCREA

Global supply chains have more links than ever, and not all of those links are completely in sync when it comes to payments, cash flow and financing. And while the current economic climate is decidedly more amicable than it was during the Great Recession, that doesn't necessarily mean buyers are cutting checks any faster (or that suppliers are getting paid any quicker). This reality creates bottlenecks in the supply chain, where even one insolvent or financially unhealthy supplier can interrupt its entire flow.

Enter supplier financing (aka supply chain financing), a concept that was popularized in the mid-2000s, when companies in nearly all industries were struggling to stay afloat. The concept is formally defined as a financing method that allows buyers to lengthen their payment terms to their suppliers while also giving those vendors the opportunity to receive payment earlier (that's where the "financing" portion—typically provided by a bank or other financing company—comes into play). Through this process, the buyer is able to optimize its own working capital while the supplier generates more cash flow to support its own operations.

Jose Aguayo, product manager for cash flow and payment solutions at UPS Capital, credits increasing globalization and the lengthening of the supply chain with driving demand for supplier financing. "Companies now rely on a complex network of suppliers and buyers that stretch across the globe to manufacture, transport, store and distribute their products," says Aguayo. "Where once the majority of a company's capital may have been allocated to properties and facilities, it now goes to working capital (e.g. inventory, receivables, etc.)."

Citing recent statistics from trade credit insurance provider Euler Hermes, Aguayo says insufficient capital is the No. 2 reason that small businesses fail, and


UNITED STATES OF AMERICA
ONE HUNDRED DOLLARS
KB 46279860

that the typical firm has 40% of its assets tied up in uninsured, unpaid invoices (one in 10 of which are delinquent). These three factors create a "perfect storm" of sorts for companies that rely heavily upon one another to keep their global supply chains running properly.

"When companies sell their goods on credit terms, they are perpetually at risk of buyer default, delinquent invoices, uninsured receivables or simply slow payments—

Improving cash flow and ensuring supplier longevity may be the key drivers of the current supply chain financing trend, but there are also other factors at work.

all of which can have devastating consequences on cash flow and profitability," says Aguayo. Smaller, younger companies often feel the biggest squeeze in these situations, mainly because they're forced to pay cash upfront when working with foreign suppliers, he explains, which typically only offer payment terms to domestic clients, large companies or long-standing clients.

"Conversely, the small company is forced to offer payment terms to its clients, because it's a common marketplace practice and because it's an attractive business practice, especially to large retailers," Aguayo says, noting that these payment terms create a time lag between when the company purchases its inventory and when it collects payments from its customers. "That lag may become longer and more difficult to manage if the company doesn't have sufficient working capital to bridge the gap," he says.

Expanding their options

From Daniel Pfeiffer's point of view as managing director of Supply Chain Finance for Wells Fargo Capital Finance, supplier financing is when either a vendor takes early payments on the basis of a large customer's sponsorship, or when a supplier attempts to sell the receivables it has accumulated from larger customers. For these scenarios, Wells Fargo Capital Finance offers supplier finance, accounts receivables finance and a structured "channel" or "distribution" finance option.

Pfeiffer says such programs are generally implemented for one of several reasons: a supplier is attempting to improve its cash position, a buyer wants to improve its cash position or a buyer wants access to new sales channels (e.g., to be able to sell more product either to a distributor or directly to a customer). Pfeiffer has seen an increased demand for all three options over the last year, despite the fact that the concept of supplier financing really took root—and grew—during leaner economic times.

"Supplier financing has been around for years but it really took off during the financial crisis, when companies were trying to more aggressively optimize cash flow," Pfeiffer notes. Since then, he says supplier financing has matured into a best practice for companies interested in extending payments terms with their suppliers and/or giving the latter options to take early payments. This trend has translated into growing demand for supplier finance solutions.

"I'm getting more inquiries about it than ever," says Pfeiffer. "As a whole, supply chain financing—and supplier financing, specifically—has slowly become an accepted practice that companies are investing in and focusing on for broader reasons than just the event that spurred it (i.e., the recession)."

The technological component

Improving cash flow and ensuring supplier longevity may be the key drivers of the current supply chain financing trend, but there are also other factors at work. For example, Aguayo says advancements in technology are also pushing more companies to explore this innovative financing approach. "Technology is allowing businesses to benefit from solutions that improve efficiencies along the supply chain," he says. As the computer programs and other technology used to support or enable banking and financial services, "fintech" has driven the development of a wide range of solutions that enable companies to conduct business much more effectively than they could in the past.

Aguayo points to sophisticated payment platforms that enable global business transactions via secured Cloud-based solutions as one example of fintech's impact on the financing industry. "Companies are shifting away from the traditional, legacy solutions such as letters of credit," he explains, "to much more effective, less expensive payment methods that enable cost reduction, improve payment velocity and improve supply chain management in general."

Fintech is also encouraging traditional lenders to develop solutions that incorporate automation and a digitized customer experience. Online lenders, for example,

have disrupted the small business lending industry by creating automated underwriting platforms that enable instant approval and a flexible funding process. "This disruption has created ripple effects across the commercial lending industry, forcing banks and financial institutions to overhaul their technology platforms and digitize their product offering," Aguayo says. "These trends are allowing businesses to gain access to capital much quicker and earlier in their supply chain."

Supplier financing also has a "dark side" that isn't always discussed. In fact, as Joe Sandor looks at how global supply chain partners are using supplier financing, he doesn't like what he sees. Having run supply chains for corporations like GM, Schlumberger and Sara Lee Corporation, Sandor is currently the Hoagland-Metzler Professor of Purchasing and Supply Management at Michigan State University. He asks: "Does extending payables as far as possible add value to either the buying firm or the supply network?" and "does delaying payments actually save money when total cost is fully understood?"

"Clearly, paying later liberates cash," Sandor admits, "but is this additional 'free cash flow' really free—and what effects does this have on overall supply network performance?" Sandor doesn't profess to have all of the answers to these questions, but he poses them because he's worried that business as a whole seems to be turning into an ecosystem of competing networks of suppliers—from Mother Earth to end consumers—versus individual firms competing with one another and working to optimize performance across those entire networks.

"In my opinion, where there is a unilateral buyer-buoyed extension of the payment terms," Sandor points out, "the trust and fairness in that relationship is violated. And that is much more costly than the one-time, apparently 'free' cash flow made possible by supplier financing."

So what's a better approach? According to Sandor, the answer lies in less focus on payables as a negotiating point and a more open, visible buyer-supplier relationship that's enabled by IT. "We should negotiate around adding value," says Sandor, who predicts that as invoicing is eliminated in favor of Paypal-esque bank transfers, the use of supplier financing will wane exponentially. "At that point," he predicts, "supply chain finance won't exist because we won't have any invoices upon which to apply the process to," he says.

Online lenders have disrupted the small business lending industry by creating automated underwriting platforms that enable instant approval and a flexible funding process.

When supply chain financing makes sense

As a large, multinational manufacturer, Siemens AG has a very large, complex supply chain that connects literally thousands of suppliers around the world. Reliant on those suppliers for both goods and services, the company has for some time now been focused on improving its days payable outstanding ratios, according to Douglas Schoch, VP of Siemens Capital Company LLC. "For the last five-plus years we've been moving toward longer payment terms in general with our suppliers," he says.

Siemens also offers a supply chain finance program through which vendors can receive faster payments—in many cases within just a few days of invoice processing. Schoch says the company has been using this approach for about eight years now, during which time the manufacturer has also "de-risked" its supply base, "due to the working capital improvements and the cash flow improvement benefits that it gives our suppliers," says Schoch. "There's definitely an appreciation for the program, which is a tool that helps both parties (supplier and buyer) simultaneously."

Expect to see more companies taking this path—or, working with outside financing firms or banks—in an effort to shore up global supply chains and ensure supplier longevity in an otherwise largely uncertain business climate. After all, an entity's financial success is largely affected by its ability to effectively manage its working capital needs along the supply chain. "Having the appropriate mechanism in place to raise cash is a key component to achieve success," Aguayo says.

And while supply chain financing may not be for everyone, there are some steps that companies can take to determine if it is a good fit—or not. "A company that is considering financing to raise capital needs to first understand the solutions available in the marketplace and determine which solution best meets the needs of the business," Aguayo concludes. "From there, understanding the cost impact relative to the financial benefit is critical to ultimately determine whether financing makes economic sense or not."

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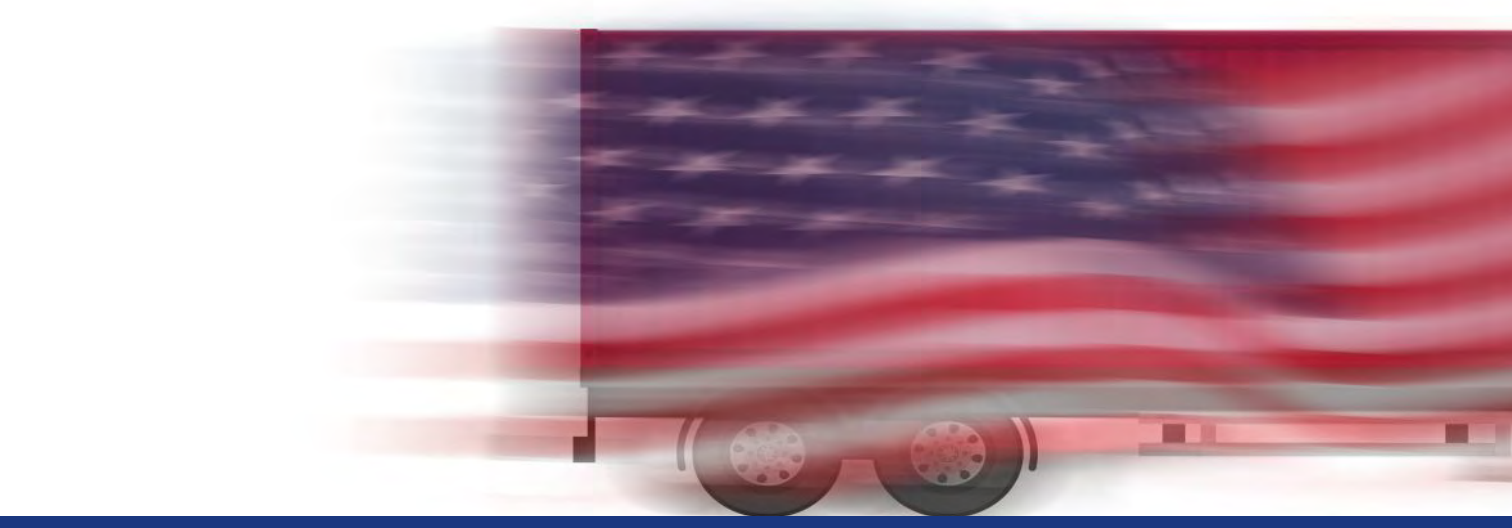

LTL: "Upbeat"

While LTL executives are bullish on the new administration's "America First" emphasis, shippers should expect rate increases in the 3% range amid a "rational" pricing landscape.

By John D. Schulz, Editor at Large

As we roll into 2017, it's clear that the $36 billion less-than-truckload (LTL) sector is enjoying a financial renaissance as carriers continue their new-found pricing discipline and resist the urge to expand capacity beyond fulfilling immediate shipper needs.

"Overall, the first quarter of 2017 is looking upbeat from an economic standpoint," says Wayne Spain, president and COO of Averitt Express, the nation's 12th-largest LTL carrier. "We're seeing many positive indicators, including comfortable growth in the months leading up to 2017 and the reaction of markets to the new presidential administration."

Others close to the market can do nothing but agree with Spain's positive sentiments. According to Satish Jindel, principal of SJ Consulting, an analyst firm that tracks the LTL sector, the new President's "America First" promise could pay dividends in the LTL sector—eventually. "It won't show up immediately, but the

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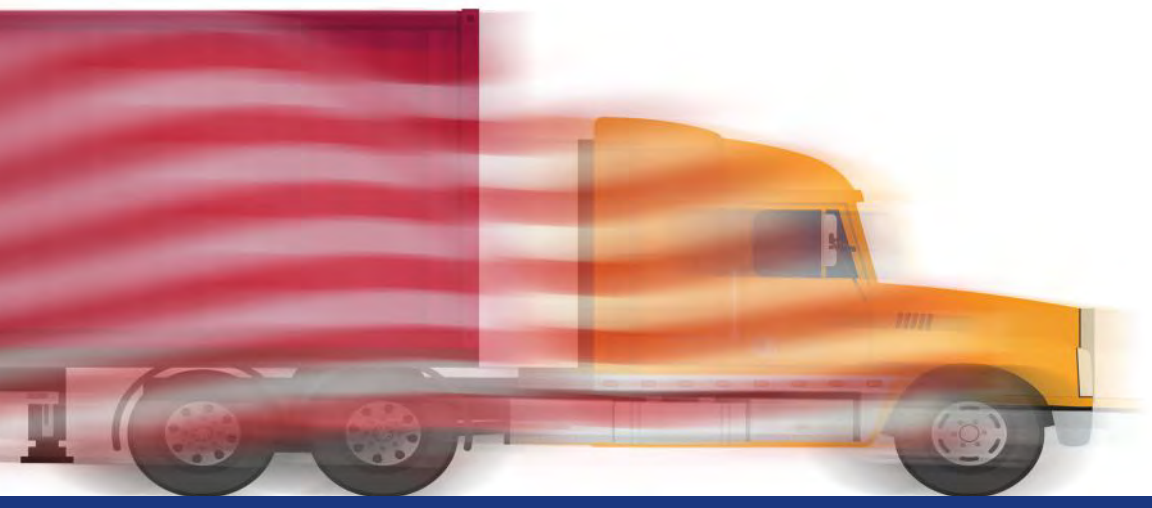


outlook for 2017

new administration's focus on keeping more business in the United States should translate into more freight," he projects. "There could be a time lag, but that should be a positive."

Brad Jacobs, chairman and CEO of XPO Logistics, parent company of the nation's 2nd-largest U.S. LTL carrier, says that he's "actually encouraged" by the overall national economic picture, both in macro trends and internal industry supply data. "Both demand and yields have been good," he says. "The pricing environment is rational and the industrial recession that had been kicking U.S. manufacturers in the stomach has been showing some signs of improvement."

According to David Ross, trucking analyst for Stifel Inc., better times are ahead for the LTL industry due to lower taxes, reduced regulation, increased capital spending and the Trump administration's stated focus on domestic jobs, infrastructure and manufacturing.

"In theory, these should all work to drive earnings higher for LTL carriers," Ross notes, adding that more money invested in infrastructure projects will increase freight demand, but will also reduce the truck driver supply because the construction industry often taps into the same potential labor pool for drivers as the LTL sector.

"We believe that 2017 will be generally good for LTL stocks, but it may be a bumpy ride, as high expectations are tested before much improvement is evident," adds Ross cautiously. And while much "educated speculation" is swirling around, let's dive a little deeper into a few factors that could drive LTL shippers' rates, capacity and negotiations over the course of 2017.

ELD effect

First and foremost, shippers need to keep in mind that electronic logging devices (ELDs) are supposed to be mandated this year. However, while those regulations are still moving forward, they are potentially subject to delay or elimination by the Trump administration.

Assuming that the rule takes effect as stated later this year, what will be the effect on LTL operations and pricing?

"ELDs should affect some capacity, and some drivers won't be able to drive extra hours," says Jindel. "Mind you, LTL carriers won't go out of business, but some on the truckload [TL] side might. However, those reduced hours on the TL side should have some spillover effect that would benefit the LTL carriers."

It's important to remember that the LTL sector, as well as most of the large TL carriers, pushed for the ELD mandate to the dismay of owner-operators, who fought the measure in the courts. At this stage, many large LTL carriers already have their fleets outfitted with the devices.

"ELDs will have no impact on our operations at all," says Chuck Hammel, president of Pitt Ohio, the nation's 17th-largest LTL carrier. "We have been fully compliant for several years now, so the initial loss of productivity we experienced on day one is now much less. I suspect most carriers are fully compliant so I don't expect much disruption at all."

Indeed, that's a compliment to the LTL sector, which outfitted most fleets long before the actual ELD rulemaking was made official.

"All of our trucks have been outfitted with ELDs," says Averitt's Spain says. "In many cases, new Averitt drivers are coming from carriers that have not implemented ELDs into their operations. There's certainly a learning curve associated with those devices; however, our drivers go through in-depth training in order to make a smooth transition."

Overall, Spain believes that ELDs will be beneficial to the industry. "They hold carriers more accountable with regards to safety on the roads, which is a benefit to everyone," he says. "We live in an age of digital information and ELDs help us in planning more efficiently. There's little doubt that the upfront costs will be offset by the inherent benefits."

YRC gets some breathing room

YRC Worldwide, parent of YRC Freight, the 2nd-largest LTL carrier, and YRC Regional, three companies that collectively make the 7th-largest LTL group, is getting some sorely needed financial breathing room.

According to YRC, the company has launched an amendment to its term loan credit agreement, including an adjustment to the leverage ratio covenant from the first quarter of 2017 through the fourth quarter of 2018.

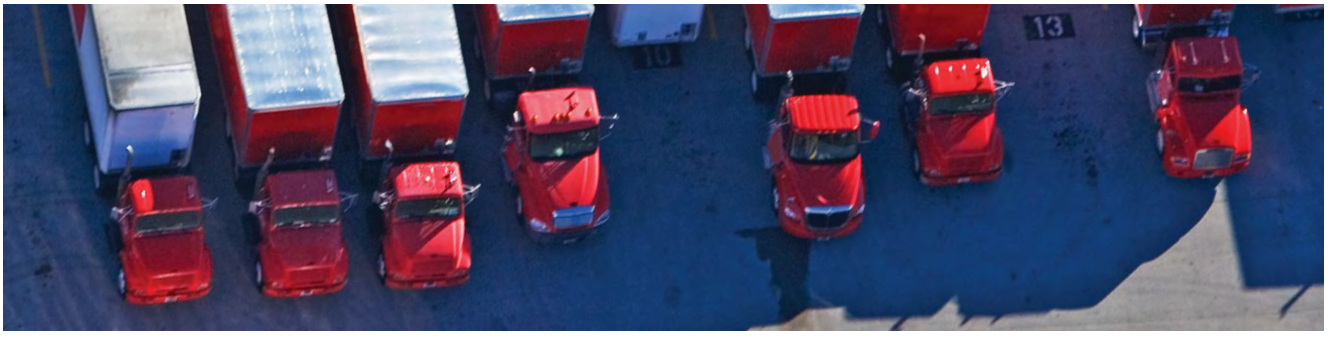
"Since 2011, we have made strides to strengthen our company, including significantly improving adjusted EBITDA and operating cash flow while reinvesting back into the business and reducing debt to the lowest level in more than a decade," said YRC Worldwide CEO James Welch in a statement.

Over the past few years, Welch noted that the LTL sector has seen tonnage decline and lower fuel surcharge revenue from falling diesel prices. "We have remained in compliance with the leverage ratio covenant since the inception of the term loan, and we are launching the amendment to take uncertainty out of the market regarding our expected ongoing compliance" said Welch.

Analyst David Ross of Stifel Inc., which has a "buy" rating on YRC, noted that YRC's improved financial picture allowed the change in the financial amendment. YRC stock zoomed nearly 12% the day the announcement was made.

In 2019, YRC has its five-year labor agreement expiring with the Teamsters union. "Fortunately for the company, we continue to believe that the industry tailwinds should be favorable this year and into next," said Ross in explaining his "buy" rating.

—John D. Schulz, contributing editor



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"I thought the conference was fantastic ... one of the best I have attended!"

William Hardy
SVP, Supply Chain, Carhartt
2016 attendee

Capacity situation

One area where LTL carriers have always held a profitability edge over their TL counterparts is capacity, and that's because the LTL sector has significant barriers to entry. Unlike point-to-point TL carriers that have few if any terminals, most large LTLs operate a complex hub-and-spoke network of hundreds of terminals. It's difficult—if not financially impossible—to replicate such a network today.

The result has been few, if any, additions to LTL capacity over the past two decades. For example, back in the 1990s FedEx Freight was the last large LTL carrier to add significant capacity in the congested Northeast region.

This simple fact has translated into unusual pricing power for the carriers. In turn, the top 10 LTL carriers control about 75% of the domestic LTL market. Recently, however, there have been whispers that perhaps two or three large LTL carriers are looking to add capacity through buying more terminals in the Northeast.

The Great Recession of 2008-2009 took as much as 20% of the capacity out of the LTL sector; and since that time, the remaining LTLs have benefited from tight capacity in the industry. That's resulted in what XPO's Jacobs and others call "rational" pricing in the market place. However, any new large entrants into a region could test that rationality, LTL executives believe.

"I hope that if carriers expand markets they focus on service that shippers aren't getting currently, not by offering a lower price," says Jindel. What worries Jindel is that some carriers may get aggressive with discounting when entering a new region. "That doesn't help that new entrant in the market place or the industry," he says.

Still, in sobering news for shippers, Jindel says that pricing should be positive for carriers due to the increased use of dimensional pricing in addition to traditional rates based on weight and distance. He adds that LTL carriers are doing a better job pricing on the actual size and dimensions of freight—not on "the honor system" of the past when carriers largely took a shipper's word for the actual size and weight of shipments.

"That should result in better pricing," Jindel predicts. "Now, that doesn't mean higher pricing—just more accurate pricing."

Jindel estimates that currently 95% of all LTL shipments are weighed for pricing, while billing accuracy is now 97%—far higher than the 85% billing accuracy of ocean freight. He adds that about half of bills of lading have errors either in weight or shipments descriptions. With far more LTL shipments being verified by weight and class of freight, often shippers receive a correct invoice, but because of past oversights, they perceive it as a rate increase.

According to analyst Ross, LTL freight demand levels, which were flat in the fourth quarter of 2016, should grow again over the course of 2017. Stifel's internal estimates are for 2% tonnage growth, "and that's likely to pick up through the year."

However, freight levels are wildly unpredictable. For example, the truck tonnage index maintained by the American Trucking Associations, fell 6.2% in December—an unusually steep decline. And that followed a 5.7% increase in November, again an usually wild upward swing.

"Due to this uncertainty, we think the risk is to the upside on tonnage in 2017," adds Ross. "Inventories should turn from a drag in 2016 to neutral in 2017, but 2018 is the wild card with significant potential upside for carriers."

Future pricing picture

By all accounts, LTL pricing is firming as carriers are more optimistic after the election and more willing to hold the line than just a couple months ago. Revenue per hundredweight—yield, not pure price—rose by an average 1.9% in third quarter of 2016.

As of this reporting, most analysts and carrier executives are predicting revenue per hundredweight yields to be slightly more than 2% this year, with overall rate increases perhaps 3% to 4%. Of course, fuel price surcharges could affect those rate increases as well; so, shippers should expect their contract pricing increases to be up modestly, with fuel surcharges rising modestly—absent any shock to global oil supplies.

"Demand is steady at the moment and pricing, while not great, is still positive," says Pitt Ohio's Hammel. However, he adds that carriers are still under cost pressure from their suppliers on everything from new trucks to insurance to health care costs. "We still need more in the way of rate increases as our costs—all of them—continue to outpace our ability to raise rates."

Still, Hammel, along with the analysts we interviewed, firmly believe that the overall business environment is positive for most LTL carriers. "We currently have a lot of new business opportunities on the table, having already on-boarded more than eight new accounts this year."

But the biggest wild card for the economy is how the new Trump administration will handle the threats to world trade. Already, FedEx chairman Fred Smith labeled Trump's move to pull out of the Trans-Pacific Partnership "unfortunate." Smith added that Trump's threat to withdraw from the North American Free Trade Agreement would have "massive economic repercussions."

Others agree. "Without a doubt, what the Trump administration does is the biggest factor affecting freight," adds XPO's Jacobs. "If it's a stimulus that gives a pop to the economy, that will help freight. If trade barriers go up that lead to geopolitical instability, those will hurt us."

John D. Schulz is editor at large for **Supply Chain Management Review**

Maturity is the key to effective analytics

Although organizations have embraced supply chain analytics, few are highly satisfied with their ability to use data to make decisions.

By Becky Partida, APQC

Many organizations have adopted analytics initiatives because of the need to aggregate vast amounts of data and automate the identification of patterns and trends. The supply chain alone produces a large enough data set that analytics can be applied to help identify areas for process and performance improvement. Data generated through internal operations, as well as transactions with suppliers and customers, can be used to determine small changes that can make a big impact on an organization with regard to efficiency gains and even cost savings.

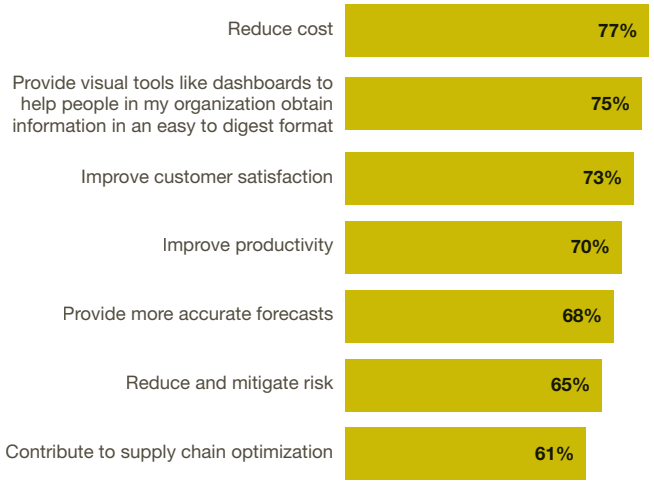
Becky Partida is senior research specialist – supply chain management, APQC

Many supply chain professionals report that their organizations have increased their investment in analytics over the last three years, according to a recent APQC survey. This survey looked at the analytics practices of organizations, as well as the structure of these efforts. APQC surveyed supply chain professionals from a variety of organization sizes and regions and from 36 industries. APQC's analysis found that organizations have several areas of focus for their supply chain analytics efforts, and that most organizations have a formal analytics structure. However, the payoff of these efforts may not be at the level organizations would expect.

FIGURE 1

Areas of focus for supply chain analytics

(% highly agree/agree)



Source: APQC

Analytics inputs and outputs

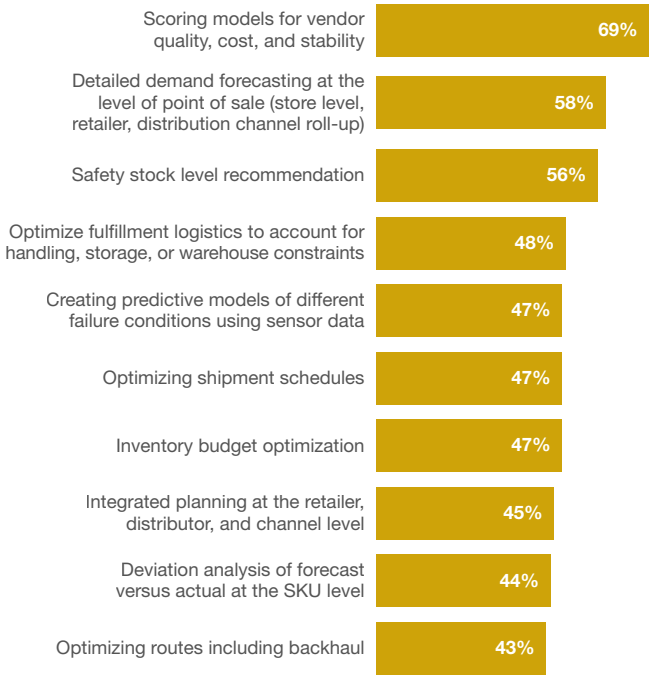
Supply chain organizations focus on a variety of goals for their use of analytics. As shown in Figure 1, when asked about seven possible goals or activities, a majority of respondents highly agree or agree that each goal or activity is an area of focus. This indicates that organizations want to see a variety of results from their supply chain analytics efforts.

Not surprisingly, the largest group of survey respondents highly agree or agree that a reduction in cost is a focus area for their organizations' analytics efforts. However, the next largest group of respondents highly agree or agree that their organizations want analytics to provide visual tools to help individuals within the organization obtain information in a way that is easy to digest. In addition to supply chain performance improvement, organizations are looking at analytics as a means of better disseminating information.

FIGURE 2

Use of analytics for supply chain activities

(% that use)



Source: APQC

In fact, organizations are pulling data from across the supply chain to feed their analytics activities. Figure 2 indicates the top 10 supply chain activities for which organizations are using analytics. Although these activities span the supply chain, the top three activities for which organizations use analytics (scoring models to assess vendors, demand forecasting and safety stock level recommendation) focus on the procurement and logistics areas.

In addition to supply chain activities on which they will focus, organizations must determine the types of analytics they will use. In its survey, APQC defined three types of analytics:

1 Descriptive analytics, which uses business intelligence combined with existing data to determine what is currently happening within a business.

2 Predictive analytics, which determines what drives a specific business outcome. This form of analytics uses historical data and various algorithms to create scenarios that can help predict future events or trends.

3 Prescriptive analytics, which involves quantifying how predictions will affect a process or goal and using optimization or embedded decision rules to find out what should be done in a certain situation. This form of analytics uses insights from predictive analytics to recommend business decisions or actions that are likely to produce a specific result.

Respondents to APQC's survey indicate that descriptive analytics is the most commonly used form across all areas of supply chain, including quality management, procurement, process management, logistics, supply chain planning and manufacturing. These results align with many organizations' efforts to evaluate current supply chain performance, as they often use this most basic form of analytics to track measures such as median costs, average satisfaction ratings and cycle times for processes.

There is some indication that organizations are adopting more complex forms of analytics. Thirty-six percent of survey respondents indicated that their organizations use predictive analytics for their supply chain planning functions, and 30% indicated that their organizations use predictive analytics in procurement.

On a smaller scale, organizations are also making use of prescriptive analytics. The largest group of respondents indicated that their organizations use prescriptive analytics for supply chain planning (15%), followed by quality management (12%). That organizations use prescriptive analytics most in these two areas is not surprising given that recommendations for what should be done would benefit these areas most. However, it is worthwhile for organizations to consider how prescriptive analytics could benefit other areas of the supply chain.

Structure and organizational attitudes

Through its survey, APQC also sought to examine how organizations are structuring their supply chain analytics efforts. As shown in Figure 3, 23% of respondents indicated that their organizations do not have a formal analytics program or structure. This indicates that, although organizations are making efforts to analyze the data produced within their supply chains, some still rely on isolated analytics activities. However, nearly one-third of respondents indicated that their organizations have a centralized analytics function for the supply chain, and just under 30% use a combination of a centralized and decentralized structure.

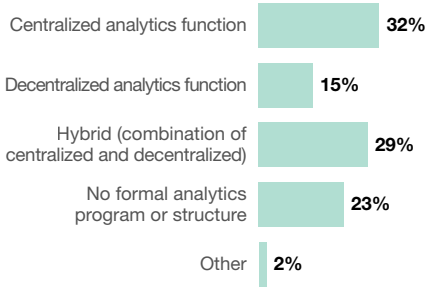
Those supply chain functions with a centralized analytics structure may reside within already data-driven enterprises. Formal program structures often result from senior leaders' appreciation for analytics across functions. In fact, a majority of survey respondents indicated they strongly agree or agree that analytics is an expected activity in their organizations whenever building a business case or conducting an improvement project.

Despite the progress organizations have made in adopting analytics programs and the degree to which they use analytics for supply chain activities, the survey respondents had a variety of responses regarding the effectiveness of their

organizations' efforts in using analytics to solve strategic supply chain challenges. Only 5% of respondents consider their organizations' use of analytics in this area to be very effective. Twenty-eight percent of respondents consider their organizations' efforts to be effective, and 44% (the largest group) consider their organizations' efforts to be average. This may reflect the fact that many organizations are still focused primarily on descriptive analytics when it comes to the supply chain rather than the more mature predictive and prescriptive analytics.

FIGURE 3

Supply chain analytics structure



Source: APQC

In a related question, APQC asked survey respondents to indicate their level of satisfaction with their organization's ability to access and analyze relevant supply chain data for timely decision making and reporting. Although a majority of respondents' organizations have a formal structure for supply chain analytics, only 2% of respondents are very satisfied with their ability to access and analyze data. Twenty-one percent indicated that they are satisfied; a majority (61%) indicated that they are only moderately or slightly satisfied. These results indicate that organizations still have progress to make when it comes to the implementation of their analytics efforts. Simply adopting analytics activities is not enough if there is not widespread access to data that can yield results.

Organizations should carefully consider whether it is possible for them to adopt a centralized structure for analytics programs. Doing so can provide strategic alignment, as well as central governance and accountability for analytics efforts.

Steps to improvement

Many organizations have room to improve the effectiveness of their analytics programs in the supply chain as well as the maturity of their analytics capabilities. To drive analytics efforts forward, one key step APQC recommends organizations take is to further develop their capabilities via an analytics team or program. Organizations should carefully consider whether it is possible for them to adopt a centralized structure for analytics programs. Doing so can provide strategic alignment, as well as central governance and accountability for analytics efforts. At the very least, organizations should establish analytics teams that function as service providers. This can increase buy-in and eliminate the potential for territorial behavior by other business units. The analytics team should include well-appointed resources with the skills needed to serve overarching organizational goals. These resources can include analytics experts who know both the limitations and possibilities of analytics, and data management experts who know where to get the data and what it means. Organizations should also include domain experts who can define problems and know how analytics insights should be used for maximum impact.

Engagement and communication play important roles in ensuring that analytics efforts are embraced by those within the organization. Communication through leadership can ensure that direct reports are well informed on how data is being used to improve supply chain processes and can create transparency that makes employees feel they are part of the analytics effort. Perhaps most importantly, communicating successes related to analytics can help convince those within the organization that an analytics program is worth any process changes needed to obtain and evaluate data.

APQC also recommends organizations take steps to ensure their analytics efforts remain relevant. Organizations should continually refine their analytics program's alignment with organizational goals so that the results of analysis are relevant to any problems the organization wants to address. They can also provide opportunities to build on previous successes and refine data needs as projects change. Organizations should keep reporting simple by focusing on key measures, and they should evaluate measures at regular intervals. This provides the opportunity to consider whether they need to shift focus to accommodate changes in the business. Through regular evaluations, organizations can consider whether their analytics programs are working efficiently and provide value for the supply chain.

About APQC

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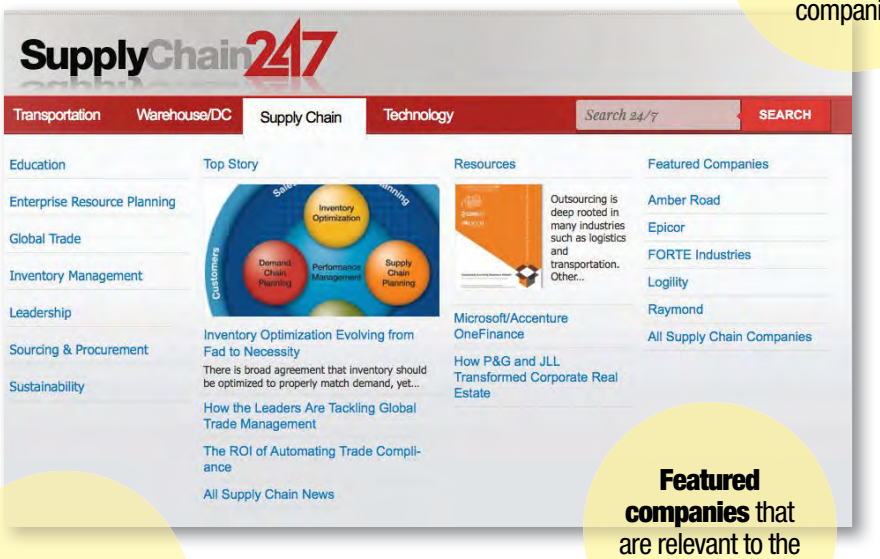

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