

SUPPLYCHAIN

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Get ready for the rebound

Last night, my wife and I shared a socially-distanced bonfire with a few friends. One was a retired physician who is spearheading the vaccination effort in the small New Hampshire city where I live. New Hampshire has had its challenges getting needles into arms like everywhere else, but it seems as if we're breaking through the log jam. For example, between week 1 and week 3, they've tripled the number of people they can vaccinate in a day, and they've expanded from five days a week to seven days a week. At least for now, there has not been a shortage of vaccines. I know there is a long way to go, but you can feel it picking up speed.

Call me an optimist, but I believe the same holds true for the economy. Yes, segments such as travel, leisure and hospitality are struggling, and the job market for many remains weak. But look a little deeper, and there's good news. The Congressional Budget Office, for instance, is projecting 3.7% economic growth for the first quarter; the outlook overseas is even better. The Fed doesn't see a return of inflation through 2023. For the supply chain, I believe its full speed ahead.

So, what comes next? That's a question we attempt to answer in this issue of SCMR. We lead off with an interview with Torsten Pilz, Honeywell's chief supply chain officer, and a former leader at SpaceX and Amazon. Honeywell was the recipient of SCMR's Resiliency Award for 2020. Pilz spoke to us about digital transformation at Honeywell, and how he and his team are

positioning the supply chain for the future.

It's followed by a look at how resilient supply chains can capitalize on organization wide-vigilance to prepare for what's next—whether that's another disruption, or a spike in demand.

Technology is going to be a central element to successful supply chains going forward, and very likely the differentiator between leaders and followers. The issue features a new strategy for the adoption of blockchain in the ocean transportation industry, a segment that is ripe for a digital transformation, and thoughts on the power of the AI-powered supply chain.

Finally, we're publishing the latest contribution from Steven A. Melnyk in his series on the future of supply chain management and supply chain managers. In "Earned preferential treatment," Melnyk and his co-authors turn to research they did with the procurement organization of a large government agency to help us understand why earned preferential treatment is elusive, and how to achieve it for lasting results.

There's plenty here for executives positioning their supply chain for the rebound.

As always, I look forward to hearing from you.



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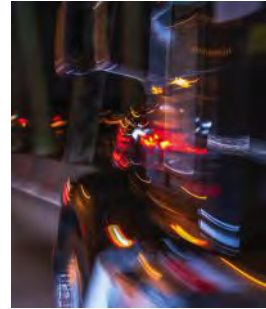
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Decision-making under uncertainty



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

Seems like everything these days is COVID-19. Recently the editor of the *Journal of Business Forecasting* asked me to write an article on demand planning under uncertainty.* Initially it sounded redundant. I asked: “Doesn’t all demand planning (as well as demand forecasting) always deal with uncertainty? After all, customers are fickle.”

Moreover, I have been teaching introductory business analytics in which I cover decision-making under risk vis-a-vis uncertainty. So, did the editor also mean risk in addition to or separate from uncertainty? This Insights column is a

slightly revised version of the article I wrote clarifying the terms risk versus uncertainty. It focuses mainly on the latter because most formal decision-making—dealing with “apparent” randomness—is statistically- and probability-based.

A textbook view of uncertainty and risk

I teach a quantitative undergraduate business-school class each semester at the University of Massachusetts in Lowell. The course I have been teaching of late is called “Introduction to Business Analytics,” a required course for undergraduate business majors. The course textbook is “Quantitative Analysis for Management” by Barry Render, Ralph M. Stair, Jr., and Michael E. Hanna. Chapter three deals with decision analysis and talks about three types of decision-making environments.

1. Decision making under certainty. “A decision-making environment in which future outcomes or states of nature are known.” This one may seem like demand-Nirvana to forecasters and supply-chain (SC) planners. However, it is not, for two reasons. The first is that if everything is known, resulting in 100% demand forecasting and planning accuracy, we would find our skills surplus to requirements. The second is that if demand is known, it might be so because the marketing and sales functions are not promoting nor developing significant new products; or their promotions are just plain ineffectual. Regarding the second point, more than likely their company’s future is not bright, and might indeed eventually die due to successful competitive threats.

2. Decision making under uncertainty. “A decision-making environment in which several outcomes or states of nature may occur. The probabilities of these outcomes, however, are not known.” Knowing what might happen in these

environments may sound comforting to a planner, but not too much. Just knowing that a known set of pandemics or earthquakes will occur doesn’t help us predict when they will happen, nor can we predict their severity. A new product launch that just resembles other product launches is only slightly more comforting. Moreover, comparing COVID-19 to arguably the closest thing to it, the flu, hasn’t helped the world successfully manage the outbreak.

3. Decision making under risk. “A decision-making environment in which several outcomes or states of nature may occur as a result of a decision or alternative. The probabilities of the outcomes or states of nature are known.” Most demand forecasting and supply chain planning practices are meant for these types of environments. Because historical data is available, statistical methods can be used to estimate various probabilities of the states of nature and statistical-based inventory management practices (for example) are well known, for example, for setting safety-stock levels.

I give students a copy of a 2019 *Wall Street Journal* article, titled “Hey CEOs, Have You Hugged the Uncertainty Monster Lately.” It discusses how sometimes “one can make lemonade out of lemon-based events.” That is, turn them into an upside advantage. It quotes an executive as saying, “As the known becomes known, a choice is to expect it, welcome it, embrace it, and make choices that create a new competitive advantage.” Thus, uncertainty offers managers an opportunity to become supply chain heroes in their companies! The events discussed in the article include global warming, financial meltdowns, 9/11 and the bursting of the dot.com bubble. So, the article supports using uncertainty rather than risk for these events where probabilities of occurrence and severity are unknown and inestimable.

Decision making under uncertainty

Given the textbook's defined decision-making environments, my July/August 2012 Insights column, "Don't Forget Supply-Side Risk" was incorrectly titled. The word "risk" should have been replaced with "uncertainty." One of the article's highlighted sentences summarized its main premise: "As the global environment becomes more uncertain, managers need to pay greater attention to risks on the supply side. A technique called decision analysis can help."

I also noted that: Supply chains have gotten longer and more global, so chances have increased that some "bad" event coming from the supply side will disrupt them. The factors that can drive this supply-side turbulence and uncertainty—political, economic and Mother Nature, to name a few—seem to be intensifying every day. Thus, while the title said risk, I was thinking uncertainty caused by events for which the probabilities of their occurrence and their impacts are unknown.

Payoff matrix for decision-making

The column and the textbook chapter on decision analysis provide a framework to support rational decision-making under both uncertainty and risk. This involves first understanding the uncertainties and/or risks, then their implications and lastly deciding what to do once these are fully understood and delineated.

The heart of the analysis is the development of a "payoff matrix" for a decision. An example is shown in Figure 1 for two possible decision options and three possible random outcomes. The rows represent different

alternative courses of action one might take. The columns represent the random states of nature or outcomes that can happen. The entries in the matrix cells represent payoffs or benefits (e.g., profits, cost savings and margins) that would occur when a specific decision was made in conjunction with the state of nature that happened. So, per the illustration, payoff12 would be the amount of payoff or overall benefit one would get if "decision 1" was taken and "state 2" occurred.

The purpose of developing the payoff matrix is to fully identify the implications of what might happen should each of the possible courses of action be taken when each of the outcomes occur. The "best" decision for a company under uncertainty depends upon its own, and its industry's aversion to risk. For example, an optimistic risk-lover might gamble to try to get the highest payoff possible, while a pessimistic risk-avertor might gamble to get the best of the worst payoffs possible.

Pharmaceutical companies are more optimistic in trying to develop high-margin, risky blockbuster drugs. The movie industry is similar, looking to make blockbuster films. Meanwhile, the retail and grocery store industries might take a

pessimistic, risk-adverse approach because they offer mostly low-margin products. Another more realistic "best" decision might also be a balance between the optimistic and pessimistic approaches. The one I cover in the course is called the "minimax regret" strategy (i.e., minimize the maximum regret of each alternative decision), which considers the opportunity cost of not selecting the best decision, if the decision maker had known an outcome in advance.

In my class, I ask students what does the following quote from the English philosopher Sir Francis Bacon mean to them, and what does it have to do with decision making: "If a man will begin with certainties, he shall end in doubts; but if he will be content to begin with doubts, he shall end in certainties."

Now, most don't have a clue, yet they do try. The best answer I've heard is: "Don't think you know everything." I point out that a decision-maker has to recognize that there is uncertainty and risk. Thus, the decision-maker should start with "doubt" by developing a payoff matrix to understand all the consequences of alternative decisions. Doing so will lead to a higher chance of getting a good outcome.

In my Insights column from September 2020, "Supply chain heroes and lessons from COVID-19," I discussed the breakdown in the food and PPE supply chains. I ended the column by saying the major learning

from the COVID-19 pandemic is to obviously support all federal and local government efforts during emergencies like pandemics. However, if you want to be a supply chain hero, think also about supplementing this support with Quick-Response(QR)** programs put in place to boost your company's revenue, even

during pandemics and potential ensuing economic downturns.

I end this column quoting Lawrence "Yogi" Berra, the great New York Yankees catcher. He was famous for his "Yogi-isms"—statements that made no sense at first glance. However, if you thought about them for a while, they were profound. One of my favorites related to decision making is: "When you come to a fork in the road, take it."

What it means is that when faced with a decision with uncertain outcomes, make a decision—don't just stand there. So, when you are tasked with decision-making under uncertainty: take action, ASAP—you might become a supply chain hero. ☺☺

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FIGURE 1

Payoff matrix

ALTERNATIVE COURSES OF ACTION	STATES OF NATURE		
	STATE 1 (e.g., pessimistic outcome)	STATE 2 (e.g., most likely outcome)	STATE 3 (e.g., optimistic outcome)
Decision 1	Payoff ₁₁	Payoff ₁₂	Payoff ₁₃
Decision 2	Payoff ₂₁	Payoff ₂₂	Payoff ₂₃

Source: Author

Enduring lessons from the COVID-19 pandemic

By Yossi Sheffi



As companies recover from the COVID-19 pandemic, more attention is being paid to the lessons learned from the global crisis. The MIT Center for Transportation & Logistics asked two leaders, Lynn Torrel, the chief procurement officer and supply chain officer at Flex, and Dave Wheeler, the chief operating officer at New Balance, to relate their pandemic experiences. The executives learned much about managing supply chains in extreme adversity, and how such a crisis requires companies to be innovative.

Common lessons

Flex helps enterprises to design and build products, and as such, operates in a business-to-business environment. New Balance is a manufacturer of athletic footwear and fitness apparel, and hence, is a consumer-facing enterprise. These differences give rise to different perspectives on the pandemic, yet the lessons learned by Torrel and Wheeler should resonate with most companies.

Speeding up digitalization. The digitalization of supply chains was underway before the coronavirus erupted in late 2019, but the pandemic accelerated this trend and illuminated how companies can harness the digital transformation of supply chains.

Torrel notes that as the disruptions reverberated through supply chains, practitioners were required to make decisions on the basis of imperfect information. This challenge “validated the investments that Flex has made over the past years in our digitalization tools,” she says. In particular, the tools helped the company make quick decisions when handling the daily challenges of managing the pandemic.

A prime example is Flex’s Pulse system that provides real-time visibility into the company’s global supply chain. Team members are able to access the system via their PCs or through one of nine Pulse Centers around the world featuring wall-length screens. While the Pulse system has been evolving since it was introduced in 2015, the pandemic added a new dimension to

this evolutionary track. An example, says Torrel, is the need to enhance the information on the status and financial health of sub-tier suppliers. Achieving this “will require third-party partners to support us with that information” she says.

At New Balance, the crisis highlighted the importance of adopting or enhancing technologies that improve responsiveness and performance.

“It all starts with the forecast,” says Wheeler. New Balance is investing in ERP and supply chain planning technology “to bring in demand sensing, incorporate point of sale information and the use of AI.” The application of 3D computer modeling to bypass the need for early-stage prototypes and 3D printing to speed up physical prototyping is another area of focus. New Balance is working with suppliers to link 3D-printed models of prototypes to bills of material to the shop floor.

Data: The lifeblood of response. Even the most sophisticated digitization tools are only as good as the data they rely on, and both companies developed new approaches to data gathering.

New Balance routinely ran projects according to traditional, long-term time frames and key milestones, explains Wheeler. During the early phase of the pandemic the organization introduced “a series of what we call agile pods (teams), that are cross-functional and have a 90-day time limit.” Driven by key deliverables in two-week sprints, this new approach makes the manufacturer more responsive.

Torrel instituted a daily call at 5:30 am with

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Flex's business leadership around the world. "That was incredibly important in how we addressed the challenges we were facing," she says. Organized around a highly structured agenda, the meetings enabled regional leaders to provide feedback from customers, suppliers and media channels on the pandemic's impact. Critical information such as changes in customer demand forecasts or changes in suppliers' delivery commitments helped the leaders to evaluate risk. "Then we would employ tiger teams to address the significant challenges we had," she says.

New paths to competitiveness. While disruptions cause instability, they also bring fresh perspectives on the commercial environment in which companies operate.

For example, in light of the COVID-19 experience, Flex believes there may be opportunities to partner with new customers "who have done their own manufacturing and want to look at maybe de-risking by using a partner like Flex to take on a portion of their production," says Torrel. Such an approach could bolster the customers' resiliency and risk mitigation efforts, she adds.

New Balance was working to build shortened lead time considerations into the design of products before the coronavirus struck. The pandemic brought this effort into sharper focus and the work intensified during 2020. An important element is how to redesign manufacturing networks to minimize lead time. In that cause, "using an outsourced specialized capability on a regionalized basis makes a lot of sense to us," Wheeler explains. This approach makes the manufacturer more responsive by, for example, bringing more precision to inventory management.

Pandemic-related role changes. The pandemic has had a significant impact on the way business leaders fulfill their roles within organizations.

Torrel says that collaboration has always been one of her leadership tenants, but the pandemic reinforced its importance. For example, during the crisis manufacturing plants around the globe opened and closed due to the pandemic, requiring Flex to shift production to support customers and maintain revenue flows. Managing this constantly changing supply picture required her to take collaboration to higher levels.

For Wheeler, one notable change in leadership style attributed to the pandemic is a more urgent need to support person-to-person interactions. In normal times, people often get together after meetings to have informal chats. A lot of work gets done during these hallway conversations he says. But these in-person asides came to an end when communications shifted to online channels such as Zoom and Teams. To compensate, Wheeler makes an extra effort to "intentionally carve out a little bit of extra time to connect with individuals."

Retaining the passion. During the pandemic both companies helped to address shortfalls in personal protective equipment (PPE) supplies.

Flex was particularly concerned with tackling the severe shortage of ventilators during the initial months of the crisis. The company worked with many ventilator producers and other critical equipment manufacturers. Importantly, Flex used its manufacturing and supply chain expertise to help ramp up the production of these units. Its engineers are adept at scaling up to mass production. The company's supply chain know-how played a key role in reducing lead times for critical parts and launching ventilator products quickly.

New Balance created a unique protective mask—a totally new direction for the company that required its supply chain team to take on unfamiliar product design responsibilities.

Again, the company's manufacturing and supply chain expertise were crucially important in enabling the team to meet the challenge. For example, a no-sew fabric used in the design of New Balance athletic shoes became a component of the mask. The design process was completed—with the help of suppliers—and production started in about one week.

Clearly, the urgent need to fight the coronavirus pandemic was the burning platform for these efforts. But will the passion and ingenuity both companies brought to bear endure after the pandemic?

"We learned a lot along the way," says Wheeler, lessons that will make the company more competitive in the future. For example, having to create a new product that is subject to tight regulation in an accelerated time frame is an experience that will benefit the company in the long-term.

Looking to the future

This theme of capturing the wisdom gained during the pandemic will surely increase in importance in 2021.

"Seeing a team come together for a common cause was the story of 2020 for us. Our solid culture was a key enabler. We surprised ourselves in our ability to come together virtually and use the tools available to us to work together in a seamless way," says Wheeler.

For Torrel, one of the biggest "aha" lessons from the pandemic is the increased prominence of supply chain. Before the crisis "nobody was really talking about supply chains, people just expected them to work and deliver products," she says. ☺☺

Yossi Sheffi's latest book is "The New (Ab) Normal: Reshaping Business and Supply Chain Strategy Beyond COVID-19," (MIT CTL Media, 2020).

The serendipity algorithm

Reducing uncertainty while increasing the entertainment value of e-commerce.

By Tony Gray

ser·en·dip·i·ty
/,serən'dipədə/

The occurrence and development of events by chance in a happy or beneficial way. "a fortunate stroke of serendipity"

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The intersection between the demand creation (R&D, marketing and sales) and demand fulfillment (sourcing, production and logistics operations) has long been the source of variability and uncertainty in planning and execution. Operations planning accuracy has long been the result of chance and art rather than of science. While sales & operations planning (S&OP) and integrated business planning (IBP) processes seek to reduce the dependence on serendipity, or luck, to improve planning accuracy, very few operations managers rely on their output when making daily execution decisions. My colleague, Rich Sherman, likes to say: "Forecasts that rely solely on historical data most often produce hysterical results." Planning focused on history does not account for marketing's objective and initiatives to cause history to change.

Harmonizing planning and execution with AI

Online sellers, retailers and, increasingly, B2B vendors employ "offering analytics" to determine the sales offerings that will most cost-effectively drive sales performance above past performance. In this context, the sales offering consists of the core offering (the primary product or primary service) and the extended offering, including fulfillment, warranties, pricing, promotions, payment terms and other services. Offering analytics techniques include the following:

Attribute analysis. Attribute analysis determines customer preference based on product and offering attributes such as color, price point and application. In e-commerce, attribute analysis outcomes are used to help customers

effectively navigate large product assortments by recommending products similar to products already selected or previously purchased. Attribute analysis is particularly effective when determining what products to offer in the event of an out of stock.

Affinity analysis. Also referred to as market-basket analysis or "go-with analysis," affinity analysis is a data-mining technique that identifies relationships between groups of products, items or categories through analysis of customer shopping carts and orders (market baskets). Affinity analysis yields which products are likely to be purchased together. E-commerce uses affinity analysis to make purchase recommendations based on current and previous purchases; for example, when buying an outdoor electric appliance, the additional purchase recommendation might be an extension cord.

Customer segmentation. On the basis of known customer attributes and previous shopping behaviors, customer segmentation can be employed to group similar customers. Assuming that all customers in the segment have similar preferences and purchase goals, a customer is presented with offerings that delivered superior sales performance when offered to other customers in the same segment.

Machine learning and neural networks. Customer data and purchase history are used to train neural networks to model customer responses to different sets of offerings. In current practice, machine learning is applied to customer segments instead of individual customers given the current complexities of developing and maintaining many trained neural networks.

Multi-variate algorithmic optimization. Multiple algorithm-based techniques are used to optimize an extended offering for a specific customer or customer segment. Algorithmic optimization can include price optimization, promotion optimization and fulfillment option pricing. Algorithmic optimization is also effective when optimizing the mix of core and extended offering components.

Applying NextGen technology

Offering analytics has shortcomings for sellers and for buyers. For sellers, while analytical techniques increase customer spend and extend the shopping cart; the limitation is that these shopping cart extensions are incremental or evolutionary. Given the competitive landscape, incremental growth and evolutionary changes are likely inadequate responses to market and supply network disruptions. Sellers need to create entirely new distinct shopping carts, discover new customer segments and find entirely new fulfillment approaches to prosper in times of market disruption.

The “*serendipity algorithm*” is an approach to analytics, optimization and machine learning that allows sellers to vary from the sets of optimal offerings (both core and extended) while realizing

sales, fulfillment and customer satisfaction benefits. In practice, offering analytics can employ serendipity techniques with the multiple practical approaches that follow:

Attribute analysis. Central to developing new and unique outcomes from attribute analysis is finding new product and service attributes. To gain competitive advantage these attributes need to be unique to the seller and not shared across the industry. Finding new attributes is no simple task; a leading global seller already manages more than 900 product level attributes. Social media analytics can reveal emerging dimensions of customer preference which can be used to define new unique product attributes. Attribute analysis should also be extended to fulfillment parameters to explore potential benefits of extended offering variants based on supply change and fulfillment.

Affinity analysis. Lower affinity rates between products may indicate that relationships between these products exist, but the seller needs to make it easier for customers to buy the products together. Product marketing/merchandising should review lower but consistent product affinities to determine if product relationships exist that have not been revealed by data science. Changes to extended offerings, in particular fulfillment options, may be required to make easier the purchase of related products.

Customer segmentation: Grouping using different attribute data and preferences (including fulfillment preferences) may reveal new segments that can be more effectively served. Discovery of new segments will be serendipitous if these segments are under-served by competitors because they fall “between” competitor customer segments. Customer sales and fulfillment histories should also be analyzed to determine if multiple customers are “hidden” within the same customer profile. An e-commerce seller may, for example, serendipitously discover that a single customer ID represents multiple members of the same household, each with their own preferences and needs.

Machine learning and neural networks. Sensitivity analysis should be performed using neural networks to determine if small changes in weights and biases yield significantly different results. “Tweaking” neural networks slightly may reveal alternate but highly probable customer decision patterns. Serendipitous benefits come when these new customer decision patterns reveal market opportunities or fulfillment scenarios not heavily exploited by competitors.

Multi-variate algorithmic optimization. One view of optimization is that the optimized sales offering represents the high point of sales performance and is surrounded by a prairie of very inferior suboptimal offerings. In reality, optimizations are more like a range of mountains with multiple peaks, each representing a local optimization result and the highest mountain in the range being the optimal offering. Rather than focusing on the highest mountain as an offering strategy, sellers should focus on local optimizations that more closely align with their sales, service, and fulfillment capabilities. Better alignment of offerings with capabilities allows sellers to execute more effectively. Avoiding the brunt of competitive forces by leaving other market participants to “climb the highest peak” will drive marketing and delivery effectiveness.

Don’t just delight me, entertain me

Serendipity approaches also benefit the customer. Effective customer satisfaction needs to go beyond filling orders. Dominant e-commerce firms succeed because they anticipate (the point of demand) unrealized needs before those needs reach the consciousness of the customer. Anticipation of needs accelerates the consumer product value chain including product development, supply management and the positioning of inventory to optimize fulfillment. The application of serendipity techniques to offering analytics will generate variations in extended offer-

ings and purchase recommendations that help the customer to understand the full range of their needs and how those needs can be fulfilled.

From the customer point of view, another challenge with offering analytics is the quality of the outcomes. Armed with faster and less expensive analytical platforms, massively connected customer profiles and better algorithms, e-commerce sellers are able to make laser-focused specific recommendations to customers. Herein lies the problem. The better these analytical recommendations become, the more they are like what we are already thinking. While the customer wants efficient commerce, value also comes from the entertainment of shopping: surprising and delighting customers.

What entertainment value is there if I order ice cream and the seller recommends chocolate sauce? Is there value in Amazon prompting me with “customers who purchased nails also purchased a hammer?” Successful selling is partly about entertainment. The serendipity algorithm can be employed to simultaneously streamline e-commerce and create extended offering variations that vary from “the usual.” Variations from the expected can increase customer perception of overall value.

Serendipity by design, not chance

The serendipity algorithm is not an equation of the form $y=mx+b$. Instead, it embodies an approach to making offering analytics less exact but more useful. In making analytical outcomes less exact, online sellers can discover new extended product offerings, underserved markets, and customer segments and more cost-effective fulfillment strategies to improve supply network performance. Equally important, the serendipity algorithm helps buyers understand and act on unrecognized needs while being entertained with a greater variety of offerings and purchase recommendations than the exactness that technology, data science and analytics deliver. ∞

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The SCMR Interview: TORSTEN PILZ

Honeywell's chief supply chain officer discusses how Honeywell kept its operations running while also ramping them up to produce much needed personal protective equipment.

BY BOB TREBILCOCK AND ABE ESHKENAZI

In 2019, *Supply Chain Management Review* launched the NextGen Supply Chain Awards, recognizing five supply chain leaders as well as five supply chain solution providers that had made noteworthy strides in the adoption of new technologies in their supply chains. Award winners are recognized at the NextGen Supply Chain Conference.

For 2020, we created the Supply Chain Resiliency award to recognize the efforts of Honeywell



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during COVID-19. Honeywell is a storied name in U.S. manufacturing across a range of industry verticals—including healthcare. Choosing only one company was not easy—there are a number of companies that went above and beyond to keep operating during the pandemic. We singled out Honeywell not just for exhibiting resiliency, but also for the way it responded to produce much needed personal protective equipment (PPE).

To help meet the unprecedented demand in the early months of the pandemic, Honeywell pressed its facilities into action. For instance, the company set up new operations at facilities in Rhode Island and Arizona to produce disposable N-95 masks. Normally, an operation like this would take nine months to set up. Honeywell was in production in only five weeks. Together, the two plants are producing millions of N-95 masks per month for health care workers, emergency responders and other critical health care needs. The shift also resulted in an estimated 1,000 new jobs during a time of rising unemployment.

At its Newhouse facility in Scotland, Honeywell started to produce 4.5 million masks a month for health care workers in the United Kingdom. That effort also created 450 jobs. And in Michigan and Germany, Honeywell used converted plants to produce hand sanitizer, which was in short supply.

Another Honeywell division worked with a team of organizations to convert 250,000 square feet of the Miami Beach convention center into a 450-bed alternative care facility with 50 ICU isolation rooms. Honeywell's role was to upgrade the circulation of fresh air in the building and also to update the convention center's security system. The combined efforts had the area ready for patients in just two and a half weeks. More recently, in January 2021, Honeywell formed a public-private partnership with Atrium Health, Tepper Sports & Entertainment and Charlotte Motor Speedway to launch a mass vaccination program for the state of North Carolina.

Leading those efforts from a supply chain perspective was Torsten Pilz, Honeywell's senior vice president and chief supply chain officer. The following conversation with Pilz from the November 2020 NextGen conference was moderated by Abe Eshkenazi, CEO of the Association for Supply Chain Management. In addition, Eshkenazi is the co-host with Bob Trebilcock, editorial director of SCMR, of The Rebound Podcast.

Eshkenazi: *Congratulations on the award, Torsten. To start, share with us some insight into Honeywell's supply chain.*

Pilz: Honeywell's supply chain is actually a pretty

massive operation. We have 200-plus factories, almost 200 distribution centers and we employ about 50,000 people. We operate on every continent outside of Antarctica. The complexity and diversity are not only visible in terms of the number of facilities, but also in terms of the number of products. We have hundreds of thousands of different products that range from aircraft engines to PPE and electronic products.

Eshkenazi: *In fact, you're the first CSCO at Honeywell. What concerns did you have taking on a new role at Honeywell?*

Pilz: If you're the first, you're taking a little risk. But at the same time, you're a trailblazer: You get to design it the way you want it and you can lead by the example you set. Early on, I talked a lot with the CEO, who is my boss. We are aligned very, very well on the strategy we want to follow. And when you feel the trust and support like I do, this is a risk worth taking.

Eshkenazi: *Honeywell started its supply chain transformation in 2019, shortly after you joined the organization. In companies I talk to, everyone has a different starting point. What was your starting point?*

Pilz: We made a strategic decision about four years ago to convert the company from an industrial conglomerate into a software industrial company. And to really create a very contemporary organization.

To execute that, we wanted to transform the supply chain, making it very modern, efficient and agile.

There are other transformation activities in the company as well. And they all support one strategic goal: to convert Honeywell into a software industrial company. For us, that was the starting point.

Eshkenazi: *As you look at your transformation over the past three years, how has it met objectives? What did you learn along the way? What would you have done differently if you were able to reset the strategy?*

Pilz: I can honestly say I would not have done many things differently. The way we have approached this was to say this is not something we can accomplish in a couple of months. We aren't just going to wake up one day and everything has changed. It's just not going to happen.

We started from the end point. We started from

where we wanted to be at a certain point in time, and then worked backward. We laid out a strategic plan that encompassed everything from footprint simplification to process improvements as well as training and development of people. We created a very comprehensive plan. We have stuck to that strategy.

The people piece is very important. Transformation takes time in a large organization like Honeywell. You have to set the course and then follow through. People have to understand it, because once you have people behind the strategy, you can create momentum. That's when things start to happen, and people realize what sort of improvements are possible. It picks up speed and you continue to make improvements and progress.

Now, we did make some adjustments along the way. We added two major components to the strategy. One was that we wanted to double down on how we think of a digital supply chain. We realized we had much of it in place already but we had to connect all the dots.

We also thought there was an opportunity to improve our automation strategy inside and outside our factories. So, we added those as additional focus areas about a year and a half ago.

Right now, I would say we are a little bit ahead of schedule, and we are beginning to pull in activities that we had planned for later. As we sit, I am relatively pleased by how far along we have come.

Dealing with a pandemic

Eshkenazi: *Let's talk about COVID. What were your first warning signs, and how did Honeywell respond? How did you discern that this was critical information that needed to be acted on?*

Pilz: We realized early last year that something was going on in China. And since we have such a global organization, it was relatively easy for us to connect those dots. We didn't have to go through much of a complicated organizational review to bring the right people together. That's one of the beauties of being a chief supply chain officer. You see it, you own it and you act on it.

Our team responded exceptionally well. We

were lucky in that we had already made the right leadership choices in Asia and elsewhere. We had the right people in place. And we created an infra-

PROFILE OF A CHIEF SUPPLY CHAIN OFFICER

Torsten Pilz joined Honeywell in July 2018 as senior vice president and the company's first chief supply chain officer. He has broad responsibilities for the integrated supply chain, including procurement and driving improvements in plant efficiency and working capital while continuing to enhance quality and delivery. Bringing supply chain to the C-Suite, Pilz reports to chairman and CEO Darius Adamczyk and serves as a company officer.

Prior to Honeywell, Pilz served as vice president, supply chain, for SpaceX, where he was responsible for planning, purchasing, material management and logistics. He built and developed a team that supported dozens of launches a year as well as the development and production of the Falcon and Falcon Heavy Rockets, the Dragon Spacecraft and the SpaceX satellite program.

Before that, he served four years as vice president, worldwide operations, at Amazon.

Pilz also spent eight years at Henkel AG & Co. in a series of roles, including senior vice president, global operations, and CEO, Schwarzkopf & Henkel Production Europe GmbH.

He earned B.S. and M.S. degrees, as well as a doctorate in chemical engineering at the Karlsruhe Institute of Technology in Germany.

structure that connected supply chain and government relations people, medical advisors, our procurement organization and our logistics team. They all worked together.

The trick was that we had trust in our regional and local teams. They had to make decisions very quickly. We came up with a rule that anything that didn't get resolved in 24 hours was immediately escalated to the next level. That ensured that teams worked together very well. Our experience in Asia prepared us for the next wave in Europe. And then once Europe was looking like Asia, we knew America would be next and we prepared for that. We created a global infrastructure that let us copy and paste processes to new regions.

Eshkenazi: *Did relationships with your vendors change?*

Pilz: We always had good relationships with our vendors. But in COVID, we extended our crisis response actions to include what was happening with our vendors and how we could help them. For instance, because of mobility restrictions, we helped vendors get the tools they needed to do their part. One thing we've learned is that there is an opportunity there for improvement. For instance, if I could wish for one thing, it would be some sort of automated insight into how each vendor is doing. That, of course, is the Holy Grail of the supply chain. I do believe we will do this in the future.

Eshkenazi: *One of the changes you made to deal with the crisis was to compress time. That's not easy for a large multi-national. How did you do that?*

Pilz: We decided early on that we needed dedicated, single-mission leaders who could make this happen. If this just becomes someone's afternoon job, it's not going to happen. You have to commit to it fully.

The second thing is that our senior leadership including the CEO, myself and business presidents, needed to commit early to support our response. That meant looking beyond the P&L. But we knew this was the right thing to do. And we learned to shortcut processes that could slow us down. It proved to be an effective leadership style.

Eshkenazi: *Actually, that's consistent with how Honeywell already operated. But you also identified a couple of new twists. Such as isolating people and reducing the amount of noise coming into them. Can you apply this beyond the crisis or was it unique to the situation?*

Pilz: It is absolutely transferable to other pieces of the operation. In fact, this is actually how startup companies are organized. The kicker is that if you want to get things done, you want to commit to dedicated resources, a single-thread leadership, a clear mission and follow up. Then good things happen.

In that model, lower parts of the organization become empowered because you are trusting them to make important decisions. This is how you multiply the power of a company. When everything has to go through a leadership committee, that becomes the bottleneck and slows things down.

Becoming resilient

Eshkenazi: *You've made excellent points about agility, resiliency and responsiveness. Let's talk about lessons learned. Can you identify some areas that are critical for a resilient and efficient supply chain going forward?*

Pilz: You need the ability to think about the status of your business and your operations. That speaks to how liquid your data is. How easy is it to access your systems? How easy is it to analyze things? The whole digital connectivity picture is important.

You also need to think about the structure and setup of your supply chain. In our case, a regional approach to the supply chain allows us to cut out a lot of the indirect relationships across the globe. That does not mean it is less cost efficient. That's where automation plays an important role. After all, we're an automation company. We sell it, so we also embrace it. If you automate, the cost differential doesn't matter in a lot of cases. You want to gain agility and resiliency.

People matter

Eshkenazi: *One of the things you mentioned earlier was the importance of people. Are we in supply chain investing enough there, or do we need to step that up?*

Pilz: Let me speak for Honeywell. When we designed our supply chain transformation, one of our five pillars was building capabilities. I cannot fathom a successful supply chain transformation without people. You're changing your footprint, re-engineering the majority of your processes and changing technology.

If you don't take care of your people and bring them along, those changes aren't going to work.

As part of our transformation, we created a new supply chain academy. We knew we had to do this to bring our people along. We also de-layered our organization to create a flatter organization. With that, our senior leaders were closer to the action, and people who never had exposure to top management suddenly did. One thing I've learned is that top people need others to tell them the truth if they're going to balance all that is going on. Otherwise, the changes won't work.

One of the things we did was to create an integrated supply chain data hub that connects the shop floor to senior leadership. Our goal is to democratize how data is used. There aren't enough data scientists in the world to rely on them alone. I need to rely on others to access this data to make decisions. You have to make it easy and accessible. Our strategy is to be super transparent. But that also means that we have to be clear about the behaviors we want to see in our organization.

Eshkenazi: *Staff development is not a short-term goal. As we're going through this pandemic, most companies are doing a lot of three- and six-month planning horizons. Those are short-term plans to get through the current crisis. How do you balance the need for a current perspective with a longer-term perspective on talent development as well as resiliency and sustainability?*

Pilz: That's an excellent question. We thought about this very hard, and our conclusion was to continue executing our long-term strategy. We are sticking to the plan.

The beauty of a well-functioning operations organization is that it can actually do both long-term and short-term planning at the same time. If you trade the long term for the short term you are not going to be successful. And vice versa. Companies always need a short-term view because they need to react to customer demand and all sorts of things that happen around the world. But we haven't changed our planning horizons. Now, if we have to make adjustments along the way, we are happy to do that.

Sustainability

Eshkenazi: *One area that has not been getting as much attention since the start of the pandemic is sustainability. And not just economic sustainability but ecological and ethical standards including labor laws. How does Honeywell view sustainability as we deal with this pandemic?*

Pilz: Sustainability and improvements in sustainability have always been at the forefront of our strategy. But I would say over the past 12 months to 18 months, we have made choices that are helpful to people in the short term and the long term.

In our view, sustainability has a social impact. As a result, we have invested heavily in education around the world. We invested in connecting with our communities. And being there for them. We have always done this. But with the pandemic, I think we have seen a ten-fold increase in this effort. We had the means to provide employment and PPE, to name two, so we did it.

And there is energy and water consumption. We have a business unit dedicated to building improvements. They are in the business of saving energy. This is what they sell to their customers. It was easy to adopt their concepts and processes internally. For instance, we have many solar power projects, and we are also focused on battery improvements. We found sustainability is absolutely the right thing to pursue. But it is also financially the right thing to do. You just do more with less and there is nothing wrong with that.

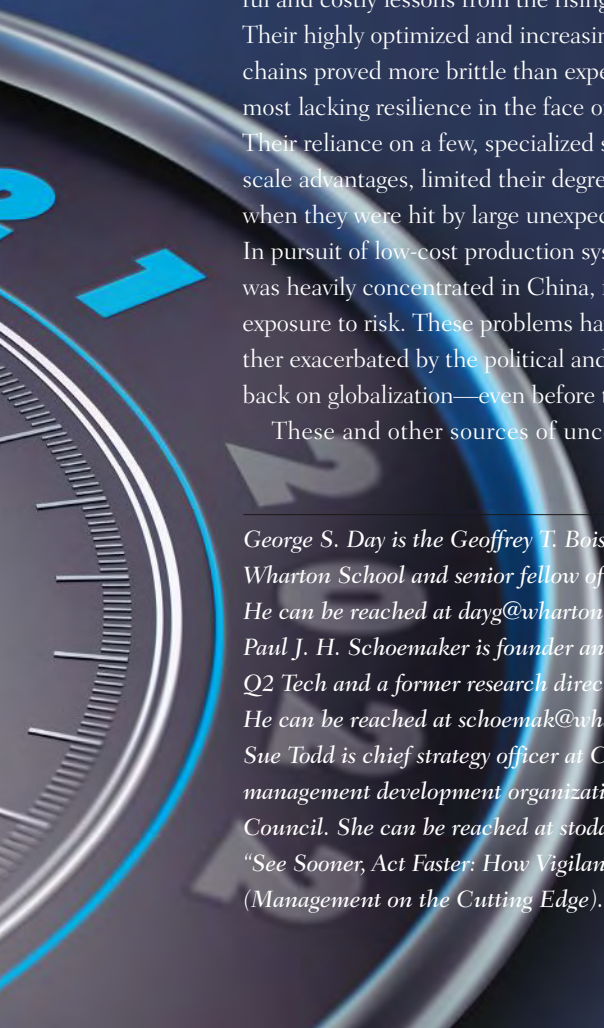
Eshkenazi: *That is excellent guidance for supply chain professionals. What do you anticipate seeing differently in the future than what we are dealing with today?*

Pilz: I wish that we had made our early decisions even earlier. The decision to connect dots and invest in people and technology are all the right decisions. I just wish we were further along. I do believe there is an untapped potential going forward. The whole point of supply chain is to connect the demand with the supply in the most efficient way. And we now live in an era when this can become a reality. To create this consistent and well-integrated platform going forward is huge. One way or another, someone will figure this out. And I hope that we are the ones to figure it out. ☺☺

Is your supply chain ready for what's next?

To improve system-wide resilience before the next disruption, supply chain leaders need to foster vigilance to handle whatever surprises will come next.

BY GEORGE S. DAY, PAUL J.H. SCHOEMAKER AND SUE TODD *



Recent generations of lean supply chains have benefited from falling trade barriers, lower logistics costs and rapid advances in digital technologies. But blithe assumptions about the stability and predictability of the ecosystems of global supply chains were upended by a series of unpleasant surprises, external shocks and above all the global pandemic of 2020.

Supply chain leaders have absorbed some painful and costly lessons from the rising turbulence. Their highly optimized and increasingly lengthy chains proved more brittle than expected—with most lacking resilience in the face of COVID-19. Their reliance on a few, specialized suppliers with scale advantages, limited their degrees of freedom when they were hit by large unexpected shocks. In pursuit of low-cost production systems, supply was heavily concentrated in China, increasing the exposure to risk. These problems have been further exacerbated by the political and social push-back on globalization—even before the pandemic.

These and other sources of uncertainty

have combined in unpredictable ways to increase turbulence. Leaders naturally wonder what else may be coming over the horizon? Inherently, the nature of uncertainty defies precise predictions about the likelihood, timing and impact of future shocks. Answers to the questions of when, where and how will always be shrouded in doubt. Still, it is quite possible to explore various zones of uncertainty that may affect future supply chains, as shown in Figure 1. The arrows linking the zones point to some of the combinations and interactions that could magnify the systemic uncertainty.

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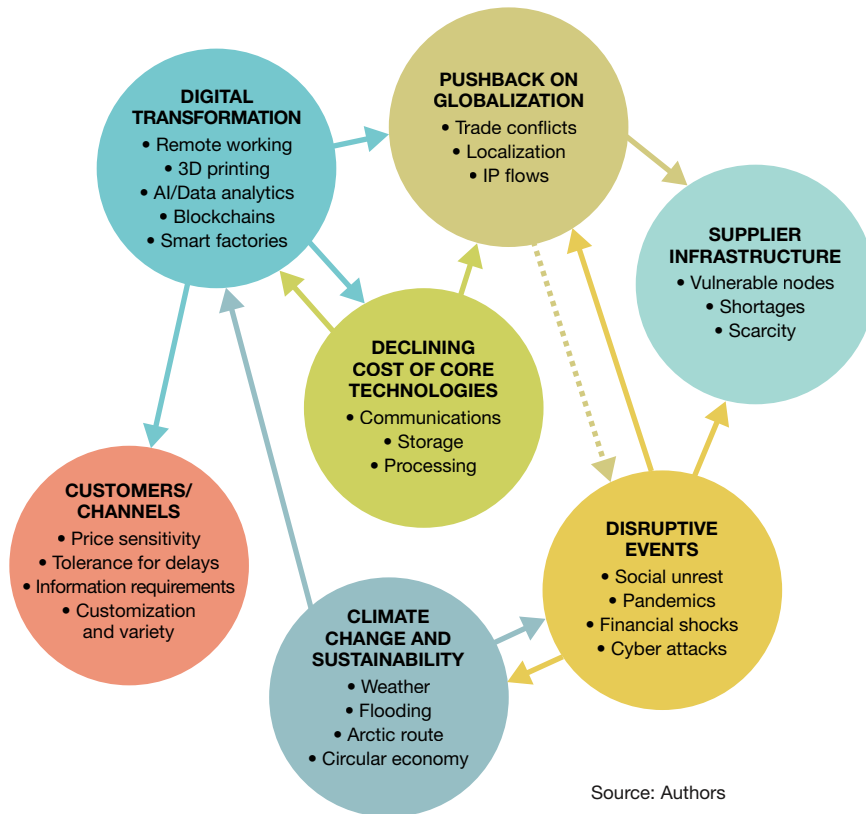
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FIGURE 1

Zones of supply chain uncertainty



stronger, especially after having been surprised. They avoid the pitfalls of wishful thinking, willful blindness, paralysis or myopia when black or grey swans surround them. Vigilant firms and their strategic leaders deliberately orchestrate more robust and resilient supply chains by following three navigation principles drawn from best practice.

Navigation principle No. 1. Vigilant supply chain leaders pay attention to what else might be coming over the horizon. While they are fire-fighting in the present by looking after their own people, taking care of their suppliers and customers and watching their cash, they are also looking ahead. While coping with CoronaChaos is all about the here and now of restoring

Disrupted supply chains and cutting fixed costs, some attention must be given to the next horizon, to be ready to pivot when the time is right.

Despite these profound uncertainties, some firms will absorb future shock waves better, and navigate greater turbulence more adroitly, than their vulnerable rivals. Resilient supply chains can capitalize on organization-wide vigilance advantages and resilience. They have honed their capabilities for anticipating looming threats and emerging opportunities sooner than their rivals. Vigilance is the collective ability to detect, share, interpret and then act on early signals of change from inside and outside the organization.

The digital transformation of industries will not pause during the crisis, and will likely accelerate other digital transformations that were already underway. Fighting the pandemic gave a major boost to digital monitoring and mitigation, for example, with companies operating virtually as much as possible. With lower costs of capital and higher margins, vigilant firms can invest in new opportunities that surface, while their vulnerable rivals are forced to cut back. Following are some general questions that supply chain leaders and other C-suite executives should ask to push organizational foresight toward the next horizon.

Improving organizational vigilance

Vigilant supply chain executives excel at seeing around corners, with a readiness to act decisively when the time is right. Also, they use this collective ability to get

What are the biggest uncertainties across the zones of uncertainty? What scenarios should management develop to capture these uncertainties and reveal interactions between zones?

What strategic moves can the firm make to diversify their supply chain, while reducing exposure to

- What are the biggest uncertainties across the zones of uncertainty? What scenarios should management develop to capture these uncertainties and reveal interactions between zones?
- What strategic moves can the firm make to diversify their supply chain, while reducing exposure to

disruptive events and logistic problems? How robust are these moves across the scenarios?

- Are there opportunistic moves we can make now; and which ones should be approached flexibly as options? Should we shift the allocation of our innovation resources? Can we redesign our products to meet the requirements of a circular system?
- What new leadership talent, experience and organizational capabilities will be needed? What new partners should we add to strengthen the ecosystem?

Navigation principle No. 2. Vigilant organizations systematically nurture dynamic capabilities that foster agility and preparedness. While at the bleeding edge of CoronaChaos, some successfully transitioned from the comfortable and known risk environments of the past (where decision outcomes could be specified and probabilities calculated) toward managing deeper uncertainties. Stable environments can usually be navigated with ordinary capabilities focused on the proficient execution of current processes, such as executing routine transactions and delivering reliable performance. To navigate deeper uncertainty, in contrast, requires a more vigilant toolkit with three dynamic capabilities: sensing change sooner than rivals, seizing opportunities more effectively and transforming the organization as needed to stay ahead.

An encouraging illustration of the benefits of being adaptive and properly aligned organizationally to adapt to external turbulence is the Stone Brewing company, the 9th largest of 8,300 craft brewing companies in the United States. At the start of the pandemic, Stone Brewing, like many other beer producers, was forced to buy back and dump millions of dollars of beer from shuttered restaurants and bars.

In what now seems like a prescient move, Stone's data analytics teams had begun to strengthen relationships with sales teams, working with each region to combine historic forecasts with direct insights from the field about demand changes. These new relationships paid off as the United States began to reopen its economy. Data analytics teams worked with regional sales managers to model demand county-by-county based on their opening dates, and new assumptions about what percentage of businesses would resume operation. Additionally, they used demand shaping principles to promote their top five beers.

Stone Brewing is now capturing new demand and climbing in its ranking as a supplier of choice as other brewers falter in matching supply levels with demand curves produced by waves of re-opening. Their experience confirms findings in July 2020 from the Resilience 360 survey of 350 firms, that while nearly three-quarters of respondents encountered some or significant detrimental effects on the supply side, there were still some winners who saw sooner and acted faster.

With the right set of capabilities, an organization can be agile when turbulence is high. Agility here means being able to move quickly and shift resources and adjust the supply chain sooner than rivals. Agile strategies require small teams to tackle an emerging opportunity or address a recent threat. A scrum of three people to nine people can be quickly assembled with all of the skills needed to carry out the initiative. Scrums essentially function as self-managing teams, following a transparent process, using design thinking methods to develop and test prototype solutions and learn quickly. These features are the antithesis of cumbersome, top-down processes with repetitive meetings, rigid command structures and other impediments to action.

Navigation principle No. 3. Vigilant organizations have a different perspective on speed than typical firms and focus on being ready to act when the time is right. In the maelstrom of a disruption like CoronaChaos, speed of supply chain adaptation will remain an especially useful and distinguishing creed. Delays usually narrow the range of strategic actions because someone else may get to them earlier. Seeing sooner also gives a vigilant firm more time to create strategic options to be exercised later as warranted. Vigilant firms have a head start on conducting due diligence about weaker rivals they may wish to acquire. One way is to prepare ahead of time with key suppliers and customers, rather than being forced to tackle key decisions in the midst of a chaotic crisis. In one case, a bulk chemical company teamed up with its main ocean carrier to develop joint "what if" scenarios about potentially disruptive uncertainties during the pandemic. These scenarios focused on uncontrollable variables like changes in fleet capacity, availability of crew, delays in port operations and other legal restrictions. By better understanding each other's hopes, fears, constraints and vulnerabilities, both firms enriched their understanding of the strategic issues involved. They

essentially rehearsed how to respond quickly, alone or jointly, if new shocks were to arise. This approach requires shared interests, a disciplined process and some trust, but in return enables faster action when needed. Scenarios have also been used for planning investments in the freight transportation infrastructure. Once laid out, the scenarios were then linked to strategic decisions the transportation planner would have to make in different scenarios.

Getting ready for the long game

Just because the clock of business is whirring faster doesn't mean that leaders must operate in haste. Acting faster than rivals is about being ready for action when needed, starting with early detection and learning through probing questions by the C-suite, followed up with exploratory forays. Only after sufficient clarity about key issues has been achieved can leaders orchestrate a more resilient supply chain system. The aim of broadly scrutinizing your supply chain for vulnerabilities now is to have strategic degrees of freedom later. When quick or bold actions are called for due to external shocks, you don't want to be boxed in by earlier moves of more agile rivals. Strategic leaders always want to act on their own terms rather than be forced to react to moves by others, and fostering organizational vigilance plays a critical role in assuring that happens.

Robust supply chains, blessed with many eyes and ears along the entire system, will be better prepared to absorb shocks and disruptions, and work hard to emerge stronger when the next shock hits. Firms like Agilent, Intuit, Sysco and Amazon have systematically developed the requisite leadership orientations, economic resources, managerial talent and system capabilities needed to seize emerging opportunities ahead of their rivals.

For example, Rockwell Automation (RA), a \$6.7 billion global producer of industrial automation and IT systems, embarked on a journey 20 months ago to improve its supply chain's agility through a centralized approach to planning and analytics. Previously, data analysis talent and capabilities were embedded into each of the key functional area: sourcing, logistics, planning and others.

RA moved its data analytics capability to a centralized team that brought together supply chain data into a

common data repository. The firm also invested in advanced planning and scheduling (APS) software to automate decision making and improve agility. It used this new system first to automate the calculations for levels of inventory safety stocks, which reduced inventory cost by more than 10% and decreased the number of decisions that planners had to review manually by more than 50%.

Additional benefits of more centralized analytics came when CoronaChaos challenged RA's global supply chains. Through its new planning system, RA had immediate visibility into overall demand, supply and inventory levels as the company's suppliers and logistics partners were disrupted by the crisis. This heightened visibility enabled extremely rapid decisions and the ability to alert anxious customers to adjusted delivery times. RA has responded effectively to the pandemic without incurring significant supply chain costs, and with few exceptions, has provided the same level of service its customers had experienced prior to the pandemic.

This kind of organizational vigilance stems from a collectively orchestrated capability driven by curiosity, candor and openness to diverse inputs. It is the antithesis of myopia, siloed thinking and being held captive by outdated conventional wisdom. Vigilant firms differ from their vulnerable rivals in many ways, including the open-minded posture of the leadership team and their collective investments in foresight capabilities that give them a significant head start. Their Boards engage the executive team in dialogues about the future through the strategic questions they ask, their diverse perspectives and broad business experience and the wider networks they can tap into.

Our research shows that the resilience of vigilant organizations in turbulent times comes primarily from four main strategic drivers that work together. We studied 118 international companies (detailed in our book, "See Sooner—Act Faster: How Vigilant Leaders Thrive in an Era of Digital Turbulence"), to determine the contribution of each driver to their vigilance advantage.

1. Leadership commitment to vigilance manifests itself when the organization is open to weak signals from diverse sources, such as customers, suppliers, logistics service providers, regulators and even media critics. This can only happen if everyone is encouraged and rewarded to explore issues outside their functional purview, and

by thinking outside the box. The more the leadership team focuses externally and nurtures curiosity throughout the entire organization, the more prescient and adaptive the company will be. Walking the talk is the *sin qua non* for leaders in bringing about genuine culture change. Without it, organizational vigilance simply will not flourish due to risk aversion, lack of role models, work overload and employee insecurity about raising issues they only partly understand. Skating on thin ice is a dangerous mid-career move and so leaders must give unqualified permission first.

2. *Investments in foresight* are made systematically, perhaps through centralized foresight units for scanning and developing possible scenarios to understand more deeply the key uncertainties. The supply chain function should develop strategic dashboards that flash early warnings when external events threaten timely deliveries. Rather than waiting to find out how key uncertainties play out, vigilant organizations proactively develop a flexible portfolio of real options so they are better to act faster when needed. Strategic dashboards are not about operational visibility, but help to spot early warnings of external changes that could materially affect the normal operation of the supply chain. As such, they complement as well as safeguard the operational dashboards.

3. *Strategy making processes* are flexible and adaptive by adopting both an “outside-in” and a “future-back” approach. Thinking from the outside-in means scanning the world around you before turning toward internal problems. Outside-in thinking allows supply leaders to have deeper insights into changing circumstances and a better understanding of suppliers or partners. By feeling their pain, hopes and constraints, your company will make wiser strategic choices going forward. Future-back thinking in this regard is about envisioning what kind of supply chain system will be needed to win when COVID-19 uncertainties subside and then getting prepared. Strategic leaders will use such future images to create receptivity to change, plant organizational seeds now and along the way to relieve perhaps some of the near-term pain of their people, customers and suppliers amid crisis.

4. *Coordination and accountability* mechanisms in well-run supply chains are properly moored in place, such that information is shared readily with those who

need it. By flagging and redressing uncoordinated activities and haphazard initiatives, the management team overseeing the supply chain can reduce decision-making ambiguities. The aim is to align the sourcing/purchase or production side of the business all the way through to distribution end of the spectrum, including customer service. Such tight coordination, reinforced by proper performance standards and incentives, are crucial in creating the right conditions for system-wide vigilance. As soon as the warning signals about the pandemic appeared, truly vigilant organizations—such as Johnson and Johnson’s health care supply chain (which Gartner ranked on top for a second year now), created “plan ahead” teams to think about the future and evaluate promising initiatives from across the firm.

While leadership teams are addressing the immediate imperatives of fire-fighting and keeping the ship stable, they must also allocate some organizational attention toward thriving in an uncertain future. But in these extraordinary times, when black swans and a tiny vicious virus pull everyone down in tandem, vigilance is also about reinvention, orchestrating greater resilience and reaping competitive advantage while many companies are befuddled.

This is not “resilience” in the usual sense of simply bouncing back and returning to normal. Instead, vigilant supply chain organizations ask: What should we be ready to do when we return to the next normal? Supply chain leaders and the C-suite can stimulate this kind of thinking by asking such questions as: What can we learn from the ongoing tumult and chaos? What must we do now to gain a competitive edge in the future? What are the organizational impediments to upgrading our vigilance capabilities? What strategic actions and change initiatives should we launch to put us in a stronger position for the future? Vigilant supply chain leaders will create sufficient mental space to get everyone prepared for whatever is next over the horizon. ☺☺

Acknowledgement: We thank Shardul Phadnis for his helpful feedback as well as the executives from the Stone Brewing Company and Rockwell Automation for sharing their organization’s lessons from COVID-19 during personal phone interviews by co-author Sue Todd.

The future of supply chain management is AI AND DATA

Speeding the information flows and reducing inefficiencies equips supply chains to operate effectively, adapt quickly and evolve to meet competitive threats and exploit opportunities in the environment.

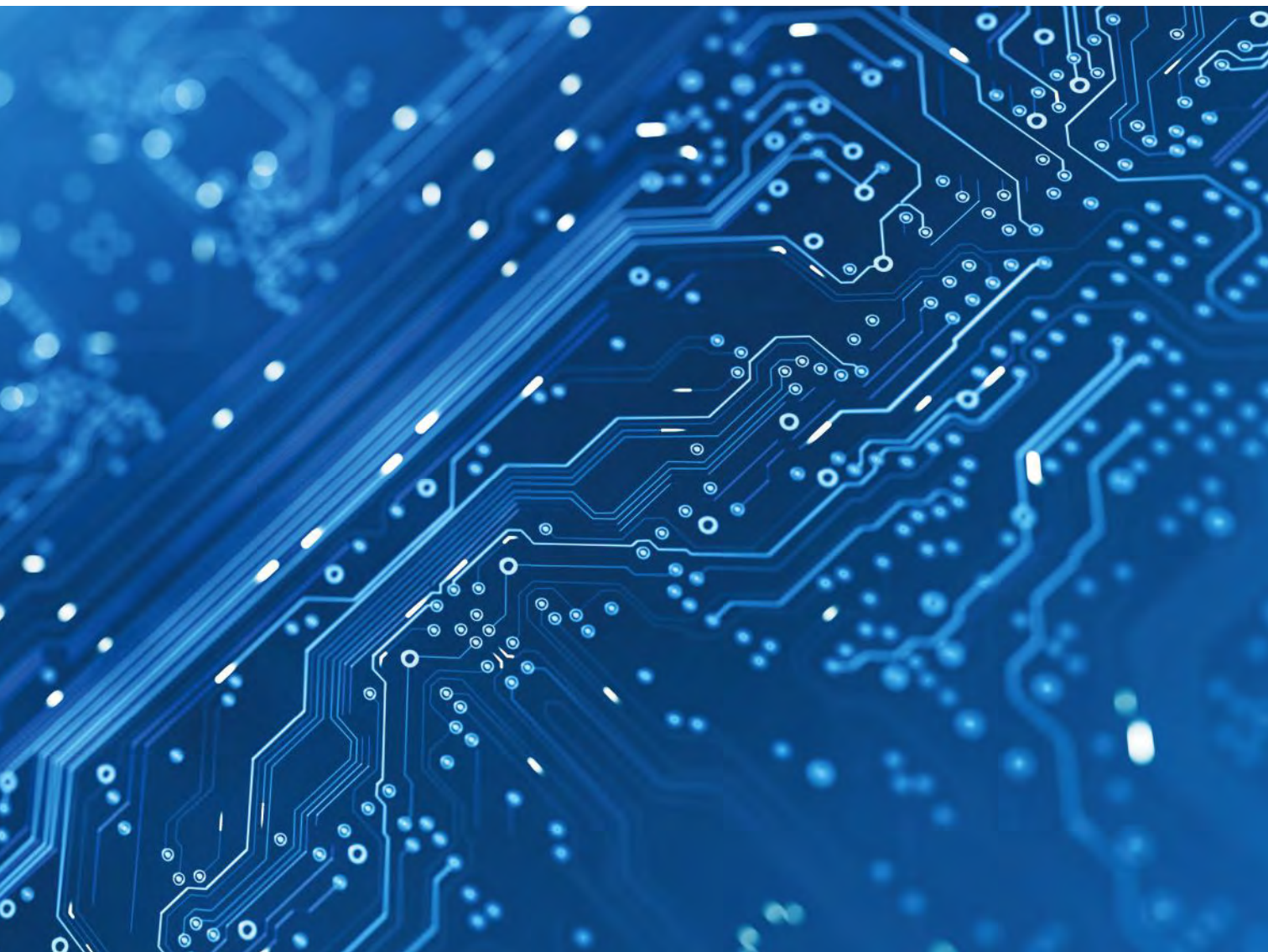
BY SETH EARLEY

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Because enterprises are like organisms in an economic ecosystem, the principles that enable a healthy biological ecosystem are, from a physical, chemical and informational perspective, identical to those that enable a healthy business ecosystem and that ensure the survival of members of that business ecosystem. Value is created by solving problems through the application of information and creativity. By speeding the information flows and reducing inefficiencies, we are equipping our part of the bigger

picture to operate effectively, adapt quickly and evolve to meet competitive threats and exploit opportunities in the environment.

Supply chains are a crucial and complex part of the information flowing in this ecosystem. They are an intricately structured and variable system that is highly sensitive, with many possible outcomes based on even minor changes in the initial conditions or components. Supply chains feature a large collection of interacting components that are difficult to understand or examine



due to their design and operations. And they represent a system in process, changing and developing over time.

It's critical to think holistically about the information ecosystem as you prepare the digital representation of various stages of product design and development. Even a product designed in isolation from other systems and groups—whether in a specialized department or in a separate contracting organization—is still part of an information ecosystem. Information that may be inconsequential to the group that is creating

the product, such as an obscure material specification that has no immediate value, will likely have value either downstream (perhaps to a distributor or engineering group) or upstream (perhaps to a procurement manager or supply chain manager).

Too often, these unseen dependencies and information relationships are neglected, and the impact of this neglect can be significant. If a piece of data that will be needed when assembling or distributing a future product is not captured, is lost or is incorrectly represented,

the cost of remediation is orders of magnitude larger than that of addressing the data need at the source.

Of course, it is difficult to know what will be important in the future without mapping out the information supply chain. Today's manufacturers and product designers do not simply design and manufacture physical goods. They design and manufacture data streams and data specifications that are as important as the good itself. But this requirement is not always well considered at the time of design. A marketer may need a piece of data that resides in engineering. Getting that data after design teams have moved on or personnel have shifted priorities is difficult and costly.

It is not feasible to capture every piece of data that could potentially be useful for an unknown downstream purpose. Instead, you need to map the data flows that correspond with the physical and manufacturing flow and collaborate with downstream consumers of the data to understand and anticipate needs. Then capture and manage that data provenance in the right structure and application and in compliance with data quality standards.

Design, manufacturing and marketing groups need to be aware of downstream processes. Each department and group must understand how the data exhaust produced by their processes is going to inform both upstream and downstream systems. Your data exhaust is someone else's data fuel.

For example, in life sciences research, antibodies are manufactured through certain processes and the data associated with those processes is critical to end users. But even more important are the ways that fellow researchers use a particular antibody in experiments that have been written up in peer-reviewed journals. How do other researchers use the associated reagents? How well did they perform under certain protocols? What were the upstream manufacturing processes? What are the downstream applications? Where did they not perform?

For your enterprise, there are similar questions. How do your processes fit in with the larger business objectives, marketing strategy, customer education and organizational processes? What information is important to customers, competitors and suppliers? What are their roles in the information ecosystem? Mapping out and understanding these dependencies is critical

to optimizing information flows beyond the immediate needs of the process at hand. Understanding and planning for these needs will help your organization differentiate based on a deeper understanding of the data. This is how your organization turns hidden data flows into a competitive advantage.

Distribution of physical goods includes distribution of data

Once products are manufactured, they need to be distributed from the point of manufacture to the point of usage. For traditional retailers, goods are moved from manufacturer to a distribution center or warehouse and then to a retail store or directly to the consumer. For business-to-business manufacturers, the supply chain can be immensely complicated, with distributors and routes to market through other manufacturers, who in turn create their products using components sourced through other manufacturers and distributors within a highly complex web of relationships.

Large brands can have tens of thousands to hundreds of thousands of suppliers. Consider the manufacturer of a complex machine such as an aircraft. According to one CNN report, an Airbus A380 contains four million parts made by 1,500 companies. The global supply chain is a complex system with many variables and influencing factors. Durable manufactured products can have decades-long lifespans, and companies need to stock replacement parts—or be prepared to manufacture them—throughout the product's usable life. This also means they need to manage the associated data throughout the product's life.

While technologies, manufacturing techniques and the sophistication level of products have become more advanced, the desire for variation and customization has increased the cost and difficulty of managing a diversity of suppliers. Competitive pressures have shortened product cycle times and accelerated fulfillment logistics while reducing inventory levels to save carrying costs. There's an enormous flow of goods and items that are highly esoteric and specific to an industry or a process, but that flow has metadata and identifiers for everything in it. Every object in your house requires a chain of manufacturers who in turn depend on other manufacturers to provide tooling, parts and materials to create their products.

Every one of these components has a metadata lifecycle



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that has flowed through the processes: from concept, through design and acquisition of raw materials, through manufacturing and across multiple distribution and logistics channels. Every physical item has an associated information lifecycle that tracks how and where it originated, where it was distributed and how it made it to the point where it is put to use.

Efficiencies in the physical movement of goods require efficiencies in the associated data flows. Tighter coordination of supplier logistics requires better integration of the data between suppliers. Organizations that want to improve the efficiencies of supply chains need to improve the efficacies of information exchange. But this also requires greater transparency and trust with trading partners. Many large organizations deal with new vendors on a weekly basis. According to Forbes, a food manufacturer dealt with 1,000 vendors for a single line of lasagna. Combine this level of complexity and volume with a lack of transparency to upstream suppliers, and problems with safety, quality and ethical sourcing become inevitable, generating PR disasters that can destroy brand trust and significantly impact the future of an organization.

In supply chains, AI can help locate interchangeable parts or substitute components, materials, alternate formulations or ingredients. It can gather and consolidate supplier data from multiple diverse sources to ensure a holistic understanding of their practices. It can also analyze agreements, past purchases and quality trends along with service-level agreements that would require costly, difficult-to-scale human analysis.

The key is once again to have an ontology that defines the correct data elements for vendor and supplier qualifications, services, terms and conditions and historical performance. Without a single source of supplier truth, this type of trend analysis is not feasible.

In fact, many organizations with complex trading partner networks are building standards that enable transparency and traceability throughout the entire supply chain. One startup called EVRYTHNG aims to create a digital identity for every single one of the 4 trillion consumer products manufactured every year, based on international standards. EVRYTHNG identities will enable tracking of not just every type of product but every individual item. The platform creates what the company calls an “active digital identity” on the web that can be accessed through a QR code or near field communication tag on the item. This

digital identity includes metadata describing the object and its whole journey from creation through distribution, eventual sale and in some cases recycling—indicating where it is as well as who has interacted with it.

One immediate application of this technology is the tracking of products in supply chains. The resulting tracking data not only provides insight into where counterfeit products are being made, it also allows companies with thousands of suppliers to see which of suppliers are productive and for which products they are excelling. Ralph Lauren is using this technology to track clothing and consumer goods; a large seafood company called Mowi uses it to track fish products from the fish farm to the supermarket or restaurant.

Consumers will also be able to interact with their own products, see where they came from and access digital services linked to the products. As Niall Murphy, CEO of EVRYTHNG, explains: “Bringing large scale data science to manufacturing and supply chain traceability is transformative.” And given this mass of real-world data, applying artificial intelligence is how companies will see the patterns and use them to improve efficiency and gain insights.

Supply chain data is at the core of transparency. The question is how to identify and prioritize the correct data elements for monitoring and management. This is done by assessing risks according to product category and severity of impact, and those classifications are controlled vocabularies that are managed in the ontology.

Procurement organizations need to understand and monitor the critical data elements and to include not just pricing, delivery logistics, quality measures and specifications but also data standards as part of their service-level agreements with suppliers. Because procurement understands the broader landscape of suppliers, it is incumbent upon that department to enforce data standards that will be leveraged by multiple downstream users and processes. If data is not in the correct format or is missing elements or of poor quality, then penalties need to be assessed just as they would be for any other product deficiency. Educating procurement on the downstream impact of data issues is critical to the optimization of the supply chain.

If you are a manufacturer that works through a network of distributors, having your data supply chain aligned with the needs of downstream consumers is even more important. You are ingesting data from your suppliers and enriching it with additional merchandising or application data elements.

You may be destroying data as you combine components into finished products, but you may also need to maintain traceability and provenance in the event of manufacturer defects and part recalls. Having traceability in the supply chain and understanding which elements can be lost or transformed is critical to demand prediction and management, source replenishment and understanding how customers buy and use your components or assemblies of components.

Ontologies enable standards

Ontologies are standards. They contain common terminology as well as data elements that allow for consistency in information structures across applications. That allows information to flow more smoothly and without manual translations, mapping or manipulation when viewing or consolidating information from different systems.

GS1 is one well-known standards organization that works across sectors. GS1 includes multiple types of identifiers such as the ubiquitous bar codes that allow retail scanners to work, plus standards for locations, assets, documents, shipments, coupons, components and parts. It also includes standards for information exchanges, including transactions, electronic data interchange, and product master data. (The digital identity that EVRYTHNG creates is based in part on the GS1 standard.)

Standards allow for the fast movement of items through supply chains and for organizations' quick and efficient tracking of inventory and transactions. These externally facing and public standards are critical to the efficient interchange of information, and they reduce the costs of transactions and data aggregation. But that does not mean that everything is made public. Internal standards can improve efficiencies even when they are not shared with other parties due to the proprietary nature of trade secrets. The organization will need to build internal standards that apply to processes, procedures, manufacturing techniques, formulas and other differentiators.

Embracing a common language and shared mental model, including appropriate standards, is part of the culture and character of the organization. A cookie-cutter, off-the-shelf standard, or one appropriated from another organization, will not fit the work style and personality of supply chain teams that have formed deep and productive working relationships. Groups should own the detailed areas of knowledge and how that knowledge is organized while also following corporate practices and well-accepted

approaches to building out effective taxonomies and ontologies. This becomes a collaborative exercise that increases employees' awareness of interdependencies and of the role and value of other parts of the organization.

B2B distribution transformation requires discipline

In distribution, any time you're moving things around, you have to predict demand. In a complex system like this, variations in seemingly unrelated areas in the physical, political and human world can have outsize impacts on supplies and market demands. Variations in weather patterns, trade issues and manufacturers of esoteric ingredients or minor components can make it hard to know how much of anything you need at one time in any location.

Machine learning and AI applications can make sense of resource management inputs and parameters and can help to identify anomalies. This contributes to determining where to allocate resourcing and spare parts inventories, or how to hedge risks in critical supply elements. By anticipating and correlating seemingly unrelated factors to map replacement and substitute parts and ingredients, you can mitigate disruptions. Success here is dependent on historical data, human judgment and an ontology that contains product, component, assembly and other relationships that inform AI programs.

Smart objects

As more physical goods are sensor-enabled, dumb, standardized manufactured commodities can be imbued with differentiated value. How much value depends on how that data is leveraged. Consider the following types of questions that smart objects in the supply chain can answer

- What features are customers using?
- How many units of the product are being used in the marketplace?
- How is the product performing—what are the effects of wear, stresses, unusual or extreme conditions, failure rates, and efficiencies? (I explore this in more detail in the next section.)
- Where is the product in the downstream channel? (At the warehouse, at the distribution center, on the manufacturer factory floor, in the finished good, at the dealer, in transit, at the final destination?)
- In what products is the component being assembled?
- What application is it being used for?

- How is it performing in a system of other components?

Based on these data points, it will be possible to offer new services for smart devices. For example, you could guarantee performance based on field data, maximize uptime for devices using the component, optimize systems of components based on conditions, refine functionality based on user feedback, or enable control of devices by remote operators.

Virtual Reality and the Internet of Things

Engineers are beginning to design advanced, connected features into products, including virtual reality integrated with maintenance, bots that provide instruction and answer questions, internet-connected sensors, monitoring, diagnosis, prediction, control, optimization and autonomy. These features make a big difference in supply chain management.

For example, my home has a generator, and because it is a decade old, the company needs to send a technician out to check on its operation and service it. The newest models do not have that antiquated requirement. They simply call home with their operating parameters and tell the supplier when they need attention. This is what manufacturing executives and managers need to prepare for: the integration of self-diagnostic and reporting capabilities, but also the necessity of managing the deluge of data from their devices.

Ontologies and content componentization are especially important when developing content that feeds applications such as virtual reality instructional materials. It is now possible to overlay design specifications on the physical part that needs to be replaced, repaired, or adjusted. That requires a content model, or content architecture, that can be assigned with terminology and identifiers that match the product to the appropriate design guides and training materials. This means that an ontology has to contain the right values for parts and instructions. Machine vision systems must have the capability to visually identify the correct component in sometimes extremely complex and difficult to access physical environments.

Intelligence can also be embedded in machinery so that, for example, a sensor-enabled device could report back operating parameters and signatures for vibration, sound and heat that could then be matched with reference data to indicate that the machinery is in need of maintenance or replacement. The machinery could even have the intelligence locally available to assist the

technician in making repairs, based on documentation updated with the latest techniques, diagnostic software and calibration from its remote connection to the factory.

When enough products have these features, entire industries can be transformed. For example, AI is even enabling autonomous operation of huge mining operations. These operations use systems of equipment that come from different manufacturers but that operate as a coordinated set of machines to monitor their shared operations, reduce human exposure to dangerous conditions and reduce operating costs. The entire mining lifecycle leverages analytics, machine intelligence and autonomous equipment to optimize operations and reduce human labor.

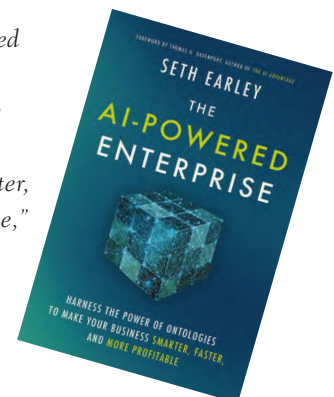
The insights that come from instrumenting and tracking physical objects enable companies to monitor and improve their strategies in real time.

Digital transformation

The relationships between the physical world and the digital world will transform how companies operate, at scales ranging from the molecular to the massive operations of mining industries.

This is especially true of the supply chain, where AI can help to optimize and make sense of supply chain dynamics, work to differentiate commodity products and use sensor data in a variety of ways that improve efficiencies. With the right ontology and data structures behind these initiatives, everything businesses do is trackable, and is therefore subject to improvement through AI techniques. This is the future of manufacturing, supply chains and even physical spaces—where everything is digitally enhanced. ∞∞

This article was adapted from "The AI-Powered Enterprise: Harness the Power of Ontologies to Make Your Business Smarter, Faster, and More Profitable," by Seth Earley, and published by LifeTree Media. It is reprinted with permission.



EXECUTIVE INSIGHTS FOR RECOVERY

Virtual training solutions are now indispensable

Q&A with **Scott C. Dunsmore**, CIT, Vice President of Training & Business Development, Lion Technology

Q: What did you see as the biggest challenge brought on by the pandemic?

A: While taking steps to ensure the safety of personnel in the supply chain, leaders were called on to digest and apply new insights about the virus every day. New workplace safety mandates required specific worker protections, administrative controls, and employee training to limit the spread of COVID-19.

Faced with quickly evolving guidance about how the virus spreads and who is most at risk, supply chain leaders had to make critical, time-sensitive decisions to protect workers and keep shipments moving.

Q: How do you suggest managers now need to approach logistics and supply chain strategies for 2021?

How must tactics change and improve?

A: The way we work changed in 2020. Some of these changes might stick, even after the COVID-19 public health emergency recedes. Organizations that do not use virtual learning as part of their training programs may be missing opportunities to simplify regulatory compliance.

As increasingly computer-savvy



generations enter the workforce, and as remote work becomes feasible for more employees, online courses and webinars will be indispensable for training new hires, refreshing training for experienced personnel, and keeping up with changing regulations.

Q: How is your organization positioned to help logistics and supply chain managers through the recovery?

A: In addition to reliable, up-to-date training for hazardous materials shippers and safety pros, Lion Technology provides our clients with updates on regulatory changes

that impact their operations. Lion continues to release consistent updates about U.S. DOT, OSHA, and EPA policies related to COVID-19—like relaxed rules for shipping hand sanitizer, listing which disinfectants are EPA-approved, and addressing employee COVID-19 training requirements created by many State safety agencies.

Lion also expanded our schedule of instructor-led webinars for 2020 and 2021, available at Lion.com/Webinars.

Q: What would you say are the most important lessons that the logistics and supply chain community has learned through this challenging year?

A: This year, we all learned just how crucial logistics and supply chain management is in extreme situations. Whether it was transporting personal protective equipment, needed hand sanitizer, vaccines packed in dry ice, medicine, or household staples like toilet paper—without the dedication of supply chain professionals, this year may have been a lot worse than it was.

We also saw firsthand the importance of clear, effective employee training on issues like hazmat shipping compliance and workplace safety.





The ocean transportation industry is facing daunting challenges. These are creating headwinds for carriers and shippers alike.

Carriers are challenged by overcapacity, as major players move to bigger and bigger vessels; fierce price competition, often at the expense of customer service; unbalanced route structures; high fuel costs; unreliable schedules and longer wait and transport times for shippers. By some estimates, paper-based operations, the traditional way to manage ocean shipping, reduces capacity by up to 15% and represents up to 20% of the cost of physical transportation, according to the supply chain platform TradeLens.

Faced with uncertain carrier delivery times, shippers are compelled to load their warehouses with just-in-case inventory, incurring higher freight and storage costs. Moreover, a significant percentage of ocean transportation capacity is reserved for large shippers operating with year-long freight contracts. This relegates small- and medium-sized shippers to the spot market, where rates for shipping are more volatile. Sometimes, even large shippers have difficulty planning their delivery cycles in the rapidly evolving global trade environment.

Keeping **PACE** with blockchain in ocean transportation

A new strategy for the adoption of blockchain has the potential to transform ocean transportation.

BY YU AMY XIA, SHILPI GROVER AND ROBERT C. LIEB



In some instances, small- and medium-sized shippers can access shared volumes, wider coverage and rate stability through shipper associations; but there remains a need for better tools that allow shippers to pool shipments quicker and cheaper, and provide a communication medium to share information without the fear of a data breach or theft. Those worries are justified: It's estimated that Maersk lost up to \$300 million from the June 2017 ransomware attack by NotPetya.

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In light of these challenges, ocean transportation is positioned for the adoption of next generation supply chain technologies that can reduce costs and improve overall efficiencies.

Blockchain is one of those technologies (see sidebar). In this article, we will discuss the current state of adoption and introduce PACE, or Permissioned, Authorization, Consolidation and Expansion, our vision for supply chain management using blockchain.

There are a number of potential benefits from blockchain.

For carriers, it has the potential to speed up and lower the costs associated with documentation processing times. The technology may also be used to balance route structures and dynamically deal with fuel cost fluctuations through the consolidation of shipments.

For shippers, blockchain can serve as an efficient and secure medium to share information among trading and logistics partners. It may also provide the collective power to negotiate better deals through a clearer picture of market dynamics. Small- and medium-sized shippers may gain the flexibility to reduce inventories, and control freight and storage costs.

It is not a stand-alone solution: Blockchain can be used in combination with other technologies such as machine learning, Artificial Intelligence and the Internet of Things (IoT) to capture and analyze data that improves speed, traceability, cargo safety and invoicing. Lastly, blockchain can differentiate one carrier from another and enhance a shipper's competitiveness in the market.

Blockchain adoption

To date, TradeLens, a collaboration between Maersk and IBM, is the largest example of blockchain in the global transportation marketplace. Launched in 2016, it is an interconnected ecosystem for ocean transportation partners that includes shippers, carriers, 3PL and 4PL companies, ports and terminals and customs authorities. As of March 2020, TradeLens included over 20 ocean carriers and providers, including the world's largest service providers, over 100 international ports and terminals and more than 10 government agencies. Standard Chartered was the first financial institution to join TradeLens.

TradeLens enables open-source collaboration, where everyone involved in a contract is responsible for their own data and has the authority to limit access to users to avoid any privacy breaches. IBM and Maersk are the owners of

the TradeLens platform. However, the shipping logistics' providers CMA CGM and MSC are authorized to jointly operate a blockchain node, and to validate transactions in consensus. CMA CGM and MSC also participate on the advisory board as part of the shared commitment to open governance. In this manner, carriers act as Trust Anchors, or validators, for the network. Other companies could also join the advisory board and gradually take on more responsibility to build and improve the blockchain ecosystem as their transactions move from paper to digital blockchain ledgers.

TradeLens is gradually incorporating smart contracts in the platform, including a set of pre-designed contracts from which shippers and carriers can choose. The documents are digitized, and many repetitive tasks are automated, to facilitate blockchain transactions. Another example of smart contract adoption is DexFreight. The startup logistics company claims that its decentralized logistics platform for food delivery allows shippers and carriers to directly connect, negotiate rates and schedule pickup and delivery. Monetary transactions are secured by Bitcoin. In our opinion, the above contracts are not "smart" yet.

We propose that further improvements are needed before contracts can become smart enough for ocean transportation operations. We call this strategy PACE.

Keeping PACE

PACE is a four-fold strategy to further the adoption of a blockchain platform in ocean transportation. The folds are: The use of *Permissioned* blockchain, the *Authorization* of roles, the *Consolidation* of shipments and the *Expansion* of blockchain internally and externally through interoperability. These four folds collectively form our proposed PACE strategy. Let's examine each.

Permissioned. Ocean transportation needs to adopt a *permissioned* blockchain instead of a permission-less blockchain for several reasons.

First, a permissioned blockchain allows limited access of users and allows more control over activities. This is particularly important as ocean transportation involves large-scale shipments and essential operational data pertaining to the businesses.

Second, a permissioned blockchain ensures only appropriate visibility to the transactional data and

maintains confidentiality of the commercial relationships between the different parties involved as required by the shipping industry.

Third, the verified and registered members of such a blockchain collectively decide nodes, and how transactions are validated. This not only enables better performance and faster response times to any updates, but also ensures security and trust in the network. Finally, the credibility of the adoption of permissioned blockchain has been proven in real-time through the examples of TradeLens and Oracle's CargoSmart blockchains powered by HyperLedger Fabric technology.

Authorization. We propose that a certain level of *authorization* should be required by every member in a permissioned blockchain. The main idea of blockchain security is peer verification. However, we believe that when blockchain technology is adopted in supply chains, the members of a permissioned blockchain should have different levels of authority defined for all activities, so that the platform can be fraud-free and each member is more responsible in their actions. In other words, to ensure that materials flow in the supply chain more efficiently, the permissioned blockchain needs a clearer structure.

This structure will promote the initiation and maintenance of the blockchain and eliminate the requirement of incentivizing the miners in the Bitcoin system, as is the case in a permission-less blockchain. In particular, the members of such a blockchain should be grouped into the following four categories.

- **Actors.** As the primary level of authority, all members who interact through the blockchain are classified as Actors and must undergo certification to maintain the circle of trust within the blockchain. This includes shippers, carriers, 3PLs, 4PLs and others. Actors with reputation and experience may be considered for service on the advisory board, which plays a major role in suggesting necessary improvements. Some actors may be asked to pay a fee to join the blockchain platform and the fee could be used to facilitate the basic functioning and maintenance of the blockchain.

- **Certifiers.** These are verified actors who are chosen to provide certifications to activities including transactions and the exchange of data on the blockchain. Certifiers for each transaction are different, depending on the consensus protocols of the blockchain. They are usually

a subset of actors who keep the ledgers for part of the transactions. Certifiers act like jury members and can be randomly chosen. It is an actor's responsibility to serve as a certifier for others.

- **Registrars.** They serve as the main administrators. Registrars work to provide keys, accounts and identities to actors in the network. They provide technology support and verify the identities of the actors. In the case of TradeLens, IBM serves as the primary registrar.

- **Parliament.** The Parliament is formed with a few select actors based on their experience, reputations and contributions to the transactions of the blockchain. Parliament members work together to define standards, schemes, policies and any technological requirements. In the case of TradeLens, the Advisory Board performs functions similar to the Parliament.

In each of these categories, authority is given to members to establish a reputation that provides a suitable baseline of authentication for any deals or contracts in the future.

Consolidation. With tight profit margins, both shippers and carriers look for ways to reduce their operational costs and improve the efficiency of their supply chains. In the PACE strategy, the *consolidation* of shipments through blockchain transactions helps shippers achieve economies of scale that can significantly improve the efficiency of ocean transportation through smart contracts.

In the proposed consolidation strategy, the blockchain will first take the details of multiple shippers and carriers across borders as inputs into the system. A pre-designed algorithm then analyzes requirements, combines shipments in the most economical way and matches them with potential carriers, thus binding them into a smart contract.

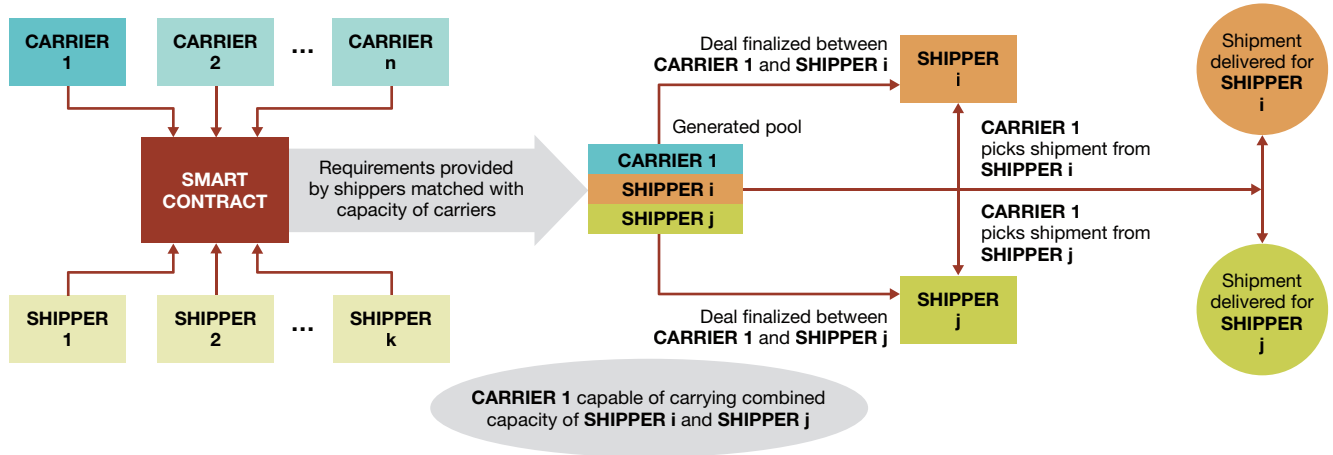
Once the match is made, the algorithm will automatically send out instructions to the carriers and shippers to conduct the shipment. The shipment process will be controlled and recorded using IoT signals that connect to the blockchain. As soon as the order is completed, payment will be facilitated and transaction records from both sides will be stored in the ledger. In other words, the blockchain will be able to facilitate a system similar to an "Uber pool" in cargo transportation, but without Uber in the middle. In addition, the consolidation can be done without the shippers or carriers revealing operational information before or

even after the deals are generated. The illustration of the process is shown in Figure 1.

be addressed. Although traditional brokers and third-party logistics companies choose to work with their preferred car-

FIGURE 1

Consolidation flow between one carrier and multiple shippers



Source: Authors

It must be noted that consolidation can happen on either side. If carriers don't receive enough cargo, the consolidation algorithm should allow carriers to combine cargoes to one vessel and share the cost of operations rather than each carrier sailing out a partially-filled vessel.

Carriers should also be able to coordinate routes when this happens. In rare cases, capacities from multiple carriers can be pooled together to serve a huge shipment. We propose that these options for consolidation among carriers utilize a vetting process, which we will discuss later.

Expansion. *Expansion* of the blockchain network internally and externally is critical to its success. Internally, a blockchain should be able to attract more actors, as has been the case with TradeLens. Externally, various blockchains should be able to connect with each other and form an ecosystem that enables sharing and visualization of information through a decentralized interoperable platform. This structure leads to the formation of what is called the "Internet of blockchains."

A platform for the ocean transportation industry can be extended to include trucking, so that shippers can receive door-to-door, multi-mode service efficiently. According to the Foreign Trade Regulations (FTR), only about 30% of the freight moved by truck is transacted on the spot market. This leaves plenty of transactional freight, and inefficiencies, to

riers, small brokers have the option to go digital in order to connect directly with the carriers, giving both the parties a fair market price in the process.

This idea is similar to the freight exchanges that have been built over the past several decades to deal with truckload freight. However, blockchain will make information sharing more secure and the process more inclusive and efficient.

It is possible for external blockchains to interoperate with one another. For example, Cosmos Hub, launched in March 2019, is the first interoperable platform that connects thousands of blockchains. In Cosmos Hub, actors of different interoperable blockchains cannot exchange tokens unless the verified members of the larger community consent to form the Inter-Blockchain Communication Protocol (IBC). Other Internet-of-Blockchain projects include Polkadot, Aion and Ark. IBM is also attempting to connect two of its own blockchains, TradeLens with FoodTrust, through an interoperable platform.

One significant benefit of an interoperable blockchain is that any changes made in the data in one blockchain can be immediately updated in another. This saves a significant amount of effort in the communication and certification processes.

An actor of one blockchain can access resources from another blockchain without deliberately joining it. For example, a farmer can connect to TradeLens through

FoodTrust, a blockchain for food processors, and access information to ship his corn to Walmart, an actor in the FoodTrust blockchain. The use of such interoperability is imperative to the success of seamless, end-to-end exchanges.

Implementing PACE, designing smart contracts

Our proposed PACE strategy for ocean transportation can not only lower shipping costs, but also significantly shorten response times and improve customer experiences in multiple dimensions. Let's explore in detail how the PACE strategy can be implemented for ocean transportation.

Initiation

There are already various shipper associations and carrier alliances in ocean transportation. Because the members of these organizations have already established levels of trust and collaboration, they can serve as the initiation groups for blockchain actors. To start the process, small- and medium-sized shippers can jump on the "permissioned" blockchain bandwagon by joining forces with them to build a network with other players. Meanwhile, carriers who are members of carrier alliances can engage in a leader-follower setting, where carriers such as Maersk can act as the nodal entity to monitor these interactions on the blockchain. Companies can also use an open-source, permission-based blockchain simulator, such as Talaris, to assess the process before fully committing to it.

Shippers and carriers who wish to gradually adopt blockchain technology can leverage their connections to first build their own alliances offline, and then construct a blockchain or join an existing blockchain. If they construct a blockchain, they can take advantage of "authorizing" and leading the platform by serving as key members of the Parliament. "Consolidation" will be easier for permissioned blockchains with fewer members. However, interoperability between blockchains is essential for organizations that choose to build their own blockchain as described in the "Expansion" part of the PACE strategy. Interoperability will help these companies connect with other players in the market even though, to date, embracing interoperability has been technically quite challenging. For that reason, joining an existing blockchain such as TradeLens is an easier approach.

We believe new blockchains will emerge soon as the challenges associated with interoperability are resolved. One to watch is the Defense Logistics Association (DLA),

which needs its own comprehensive security and "authorization" system. Different geographical areas may start their own blockchains to have logistical convenience. Various functional groups such as trucking companies may build their own blockchains for easy shipment consolidation. These new blockchains will then connect and compete with TradeLens in a collaborative environment to further improve security and cost efficiencies.

Smart contracts

The consolidation strategy we propose will be implemented through the use of smart contracts in blockchain. For every consolidation, each carrier will be evaluated on factors such as updated available capacity, category of items that its vessels can carry, destinations in their reach, times of availability, price menu and details on the condition of available vehicles, including gas mileage and carbon emission rates. Once a shipper places a shipment request, it will be asked to provide details such as the category of items to be shipped and container numbers and sizes.

If the blockchain platform extends to trucking services, additional details such as weight of the packages and pickup and delivery locations will be required. As the shipper submits the necessary information, pre-designed algorithms will find a suitable match from the pool of shippers and match them with potential carrier, thereby generating an optimal consolidation option.

Carriers and shippers will then have the opportunity to finalize the deal, either through conventional means or through automated, pre-designed smart contracts based on the reputation of the shippers and carriers on the blockchain. A finalized deal is then an activated smart contract. Note that carriers and shippers have the option to remain anonymous during the deal generating process.

Smart contracts will be stored on the blockchain; if the above conditions are met between the carrier and the shipper, the contract will execute automatically through IoT signals. Such a contract will automatically prompt digital invoicing and payment once the order is completed, eliminating the requirement of human intervention altogether and dramatically simplifying finance operations.

The deterministic nature of smart contracts makes them more reliable and fraud-free in a world where transacting with a completely unknown party can be extremely risky. However, once the smart contract is signed digitally, the participating bodies, including carriers and shippers,

no longer have the option to withdraw from the contract. This type of a business model generates automatic deals without any discrimination of either party.

It also enables large carriers to generate more business by sharing capacities without the addition of any administrative and documentary costs. Meanwhile, small shippers will have the opportunity to leverage economic benefits through automatic consolidation and the elimination of middlemen. Such deals should lower the delivery costs for small and occasional shippers by consolidating shipments with each other.

Figures 2A and 2B demonstrate two types of contracts generated between a carrier and multiple shippers, one is time-triggered and the other is volume-triggered. In Figure 2a, the carrier is bound through one contract that is automatically developed if a carrier has unfilled capacity in a vessel that is scheduled to leave. The carrier submits an invitation to potential shippers with a deal. This event is time-triggered, such that even if 80% of the capacity of the carrier's vessel is filled by the time the ship must sail,

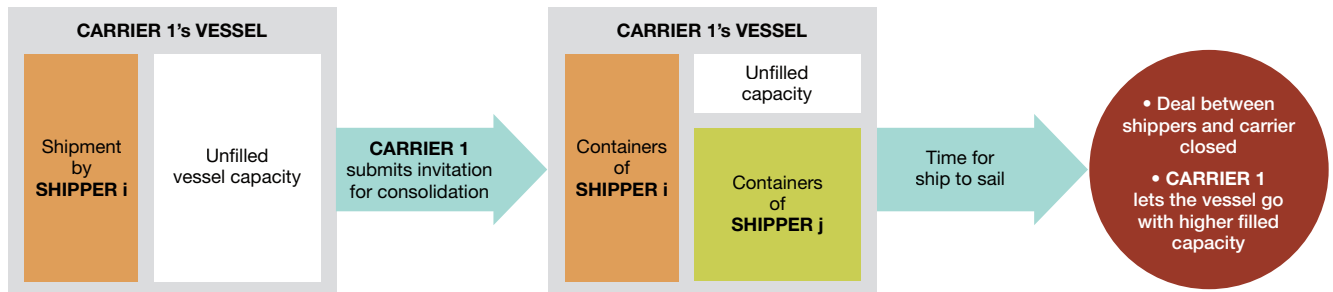
the deal will close as is. This process is similar to how Uber allows passengers to share rides while reducing its individual fares per mile.

In Figure 2b, a contract is built if a shipper initiates a request for consolidation when looking for a deal within the system. The system then generates options from a pool of shippers that are willing to ship their containers together to fulfill the capacity of the deal. This is a volume-triggered event that would be specifically helpful in receiving discounted rates for all of the shippers collectively to deliver their shipments in the same vessel. This process is similar to the operations of Groupon, which pools the purchasing power of buyers together. Once the volume of the discount is reached, the deal is closed.

Smart contracts are useful for several reasons. First, they can be used to track and validate the movement of products in the supply chain on a real time basis. This is useful for small shippers and carriers that still rely on spreadsheets, notebooks and telephones to conduct businesses.

FIGURE 2A

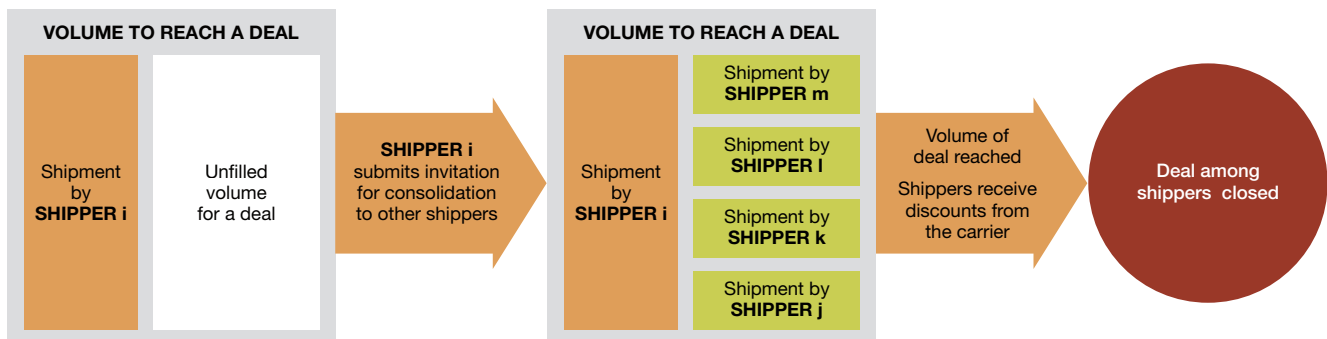
Development of time-triggered smart contract initiated by a carrier



Source: Authors

FIGURE 2B

Development of volume-triggered smart contract initiated by a shipper



Source: Authors

Second, smart contracts facilitate faster transaction times, secured payments and less documentation for everyone. This, in turn, reduces the carbon footprint by tracking critical information and gives shippers and carriers the confidence that the model is reliable. Third, it provides companies with no past relationships an opportunity to work together, assuming that they have been previously vetted, and eliminates the need for middlemen. That lowers the costs for everyone.

Block chain and smart contracts

Blockchain is a shared digital ledger consisting of a list of connected blocks that are stored on a decentralized distributed network.

This network is secured through cryptography, where each block contains encrypted information and is connected to the previous block through a hash—a computer science function that can convert input of letters and numbers into an encrypted output. As a result, blockchain is considered tamper proof; if anyone makes a change in one hash, it triggers changes in the corresponding hash, which in turn notifies the entire chain immediately.

A blockchain becomes even more powerful when it incorporates smart contracts. These are simply an if/then conditioned software program that uses blockchain to execute a deterministic agreement. Smart contracts make blockchain dynamic, secure and cost-effective for supply chain management.

Evaluation of blockchain actors

There is a need to build an evaluation system for blockchain actors based on the “authority” aspect of the PACE strategy. The evaluation system should be decentralized to ensure that the actors perform to the best of their abilities and only authentic information is shared in the system. The evaluation record will be developed based on accumulated experience and reputation by the individual carriers and shippers over time and will be a part of the blockchain ledger. Each evaluation submitted by peers will be verified with the

blockchain record history and stamped. This will ensure that the evaluation records cannot be falsified.

To ensure that both shippers and carriers feel secure about the execution of smart contracts, we propose the concept of vetting for all blockchain actors. This concept will include details related to the carriers such as Safety and Fitness Electronic Records (SAFER) rating, financial stability, insurance coverage and vessel’s age and condition. Details about shippers will include the shippers’ historical shipment records, financial information and transaction history. To initiate pooling, a smart contract will be voluntarily constructed through validated shippers and carriers. Additional players could be added after they are validated based on information such as their performance data and criminal record history. Players with a poor rating could be removed from the pool based on continuously evolving data stored in the system.

The time is now

The ocean transportation marketplace has never been more competitive. Nor, as a result of COVID, have supply chains been more vulnerable to the uncertainties in transportation. In the first week of April 2020 alone, more than 160 sailings stood cancelled, and the biggest international carriers were expected to lose between \$800 million to \$23 billion due to the pandemic. To mitigate supply risks, it is essential that shippers lock in limited transportation resources to secure their recovery plans.

To meet the challenges of the future, the ocean transportation industry needs to move away from paper bill-of-ladings and face-to-face meetings and adopt innovative technologies, including blockchain, that can improve service and reduce costs, especially for small- and medium-sized shippers. The TradeLens network has already demonstrated the viability of blockchain in the industry. However, as confidential data is put at stake, it is important that legitimate entities share access and that rules for information-sharing are clearly defined in participation agreements. While a permissioned blockchain significantly lowers the risk of a cyber attack, it is equally critical that a robust risk management plan is in place that includes the governance model, relevant regulatory requirements and logical flaws in smart contracts.

The further expansion and adoption of blockchain in ocean transportation, as well as in supply chain management, requires deep diving into the other challenges posed by this technology and continuous innovation and development in all areas. ☞☞

The lure of “earned preferential treatment”

EPT is viewed as the reward for being a good customer. But what does it mean, and how do you achieve it for lasting results and competitive advantage?

BY STEVEN A. MELNYK, CHRIS PETERS, TOBIAS SCHOENHERR AND JASON MILLER

There has always been something different, something attractive about the phrase “earned preferential treatment” (EPT). It implies that the buyer and their organization is treated differently—like a VIP. It implies perks and benefits not available to others. It implies strongly that the firm is important to the supplier and there exists goodwill and trust between the buyer and the supplier. Yet, a challenge facing most organizations is that of how to win this status.

Many organizations think that you gain this benefit by virtue of better transaction management—paying on time. Other equate EPT with the volume of business—the more that you buy, the more likely you are to gain EPT. The reality is that these views are both right—and both wrong. They are incomplete. They do understand that such a status is a prize that is gained by a process. At the heart of this process is an important issue: “Are you a good customer?” It is the position of this paper that you cannot earn EPT unless you are seen by your suppliers as being a good customer. However, as will be discussed at the end of this paper, being a good customer, while important, is not enough by itself.



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Earned preferential treatment

Here we will explore the concept of EPT by answering the following questions:

- What is EPT?
- Why is EPT even more important now than in the past?
- What does it mean to be a “good” customer?
- Is being a good customer enough?

EPT: The concept

Like Match.com, supply chains bring together two parties—suppliers and buyers. To date, the focus has been primarily on the buyer’s assessment of the effectiveness of the supplier. Largely overlooked has been an exploration of this relationship from the supplier’s perspective. This assessment has taken the form of what Joe Sandor, the former chief procurement officer of Sara Lee and a regular contributor to *SCMR*, termed “earned preferential treatment.”

EPT means that the buying organization has achieved a special status—one in which it is treated differently. For the supplier, EPT denotes that the buying organization has become a critical customer to the supplier. Yet, EPT is the result of a process (see Figure 1) that brings together being a “good” customer, good supplier relationships and EPT. When a buying organization is seen as a “good” customer, they naturally become more attractive to suppliers—current and potential; Tier 1, Tier 2, Tier 3 and beyond.

FIGURE 1

The process of earning EPT status



Source: Authors

Becoming a preferred customer can be viewed as an example of the law of criticality in action—the recognition that not everything is equally important. This law applies to many aspects of supply chain management: processes, capacity, measures and customers.

To become viewed as a good, or preferred customer, it’s not enough to place orders (especially large orders) and pay your bills on time. It involves aspects such as follows.

- **Supplier treatment.** Are the interactions with

the buyer fair, open and honest? Does the buyer treat the supplier as a trusted partner? Does the buyer understand and accommodate possible limitations and constraints faced by the buyer? Such limitations could be both financial and operational.

- **Supplier development.** Does the buyer work with the supplier and help to improve the supplier’s ability to improve performance? Does the buyer invest in the supplier, with the goal of helping the supplier to become better?

- **Buyer commitment to the supplier.**

Is the buyer willing to work with the supplier over the long-term (through the good and bad times)? Is the buyer willing to help the supplier during downturns, recognizing that suppliers, especially small-to medium-sized enterprises may lack the resources necessary to weather such economic storms?

- **Buyer-supplier communication.** Is there an ongoing flow of information between the buyer and the seller (or is the communication limited only to when orders are placed, or problems encountered)? Is the buyer willing to listen to the supplier? Is the buyer open to suggestions and comments put forth by the supplier?

- **Supplier integration.** Does the buyer work to help integrate the supplier into the buying network by identifying what has to be done to ensure the complete and open transfer and protection of information and data, sensitive or otherwise?

As previously noted, these issues are often overlooked because the primary focus is on buyers and what they are looking for in potentially good suppliers. There is an exception to this view, and it involves the automotive industry.

The Working Relationship Index (WRI)

One of the features of the automotive supply chain is the Working Relationship Index, or WRI, which went through its 20th iteration in 2020. Initiated by John Henke, a professor at Oakland University in Saginaw, Michigan, the WRI surveyed suppliers to the largest North American automakers, including General Motors, Ford, Chrysler (now FCA US), Toyota, Honda and Nissan. The study sought to identify the factors that influenced these interactions, a factor that Henke referred to as “supplier trust.”

It should be noted that this survey is both unique, in that the authors are unaware of a similar survey in another industry, and limited because it only includes Tier 1 suppliers that work directly with the selected automotive OEMs.*

The survey consists of 23 items that suppliers are asked to assess. These 23 items are then categorized into five broad areas: OEM-supplier relationship; OEM communication; OEM help; OEM hindrance; and supplier profit opportunity. Ultimately, these items are reduced to one index or score—the WRI.

Scoring high on this index is coveted by the OEMs. Taking it one step further, the authors of the WRI sought to quantify whether there was a correlation between scoring high in the index and overall operating income compared to the other OEMs in the survey. The answer was an overall improvement of more than \$2 billion. In other words, good buyer-supplier relationships are critical strategically, operationally and financially.

Securing EPT is becoming critical now

For many readers, the benefits of EPT are obvious—lower costs, better service, access to innovation and new developments first. Yet, while important, these benefits overlook the most important reason that EPT is important now. EPT is needed because, without it, firms cannot hope to achieve the new outcomes with which their supply chains are charged to achieve.

Even prior to the pandemic, supply chain were being asked to operate differently, with a new focus on outcomes such as improved sustainability, better transparency, enhanced cybersecurity or the implementation of digitalization. These outcomes pose some important challenges.

For instance, before they can be realized, each stage of the supply chain must commit to and be involved in the outcome, and each tier must be willing to make the necessary investments. For some outcomes, such as cybersecurity, this may create a potential problem due to two factors: (1) the size of the firm; and (2) the inability to generate a compelling business case.

Suppliers come in all sizes. However, little attention has been paid to suppliers from small- to medium-sized organizations (SMEs), usually defined as suppliers with 500 or fewer employees. Yet, these SMEs are critical

to the supply chain because they produce innovative and/or niche products that crucial to their larger OEM customers. More importantly, these firms are often built around certain, hard-to-obtain, but critical skills and capabilities. Because they are small, they are less bureaucratic and more agile, capable of moving quickly to take advantage of new opportunities.

Yet, their size also creates a major problem. Relative to large firms, SMEs are often chronically underfunded with a diminished ability to secure rapid access to additional funding. After all, such firms have lower capitalization; they have lower or non-existent credit ratings than their customers, yet they are heavily dependent on credit for operating income; and, they have fewer financial options. This trait, inherent in almost all SMEs, contributes to the second factor, the inability to generate a compelling business case.

We are currently seeing these two factors playing out around the 889 mandate, a section of the John S. McCain National Defense Authorization Act for Fiscal Year 2019 that prohibits the federal government from directly procuring any equipment, system or service that uses prohibited Chinese technology coming from companies such as Huawei and ZTE.

For many small companies, compliance with the 889 mandate requires a significant investment, one that a small ball bearing manufacturer that serves the DoD estimated at more than \$3 million. An investment of this size presents two challenges. First, such firms may have difficulty securing access to the necessary funding. Or, as in the case of the ball bearing manufacturer, they may decide that they simply can't generate a compelling business case and pass on the opportunity.

When these investments are not made, weaknesses in the supply chain emerge. Outcomes such as enhanced supply chain cybersecurity are not achieved. Rather, what occurs is the presence of negative supply chain externalities—where actions taken by one supplier (often acting at a lower tier) create problems and costs that are incurred by the firm, such as a cybersecurity breach.

EPT, and being a good customer, provides a partial solution to this situation, fostering the emergence of goodwill and trust. These conditions encourage suppliers to make the necessary investments.

Insights into being a good customer

At the heart of the survey were the traits that suppliers looked for when evaluating whether a buying organization was a “good” customer. To identify these traits, the research team drew on the following resources.

- An extensive literature review focusing on buyer-supplier relationships, supplier assessment and customer attributes. From this literature review, a number of key constructs and issues were identified and included.
- Discussion with current purchasers and representatives from small- to medium-sized suppliers. During this stage, the authors reached out to contact people who were involved in the buyer-supplier relationship. This pool consisted of people who worked within the government, and those who worked primarily in the private sector. As part of this outreach, one of the research team members solicited input from the Supply Chain

Management Alumni of Michigan State University, one of the oldest, largest and best regarded supply chain management programs in the country.

- Discussions from experts in this area—both academic and industry consultants.

From these various sources, the research team identified 21 different attributes, summarized in Table 1.

Launching the survey

Early in the project development, it was agreed that this survey would primarily target SMEs. Second, the survey would not simply target current suppliers, rather, it would take a broader scope by including respondents from three separate groups: (1) those who are currently suppliers to a government agency we identified as GOV; (2) those who were once, but are no longer GOV suppliers; and, (3) those who have never been GOV suppliers. Finally, the survey would broaden the scope to include not only Tier 1 suppliers, similar to WRI studies, but also Tier 2, Tier 3 and Tier 4 suppliers.

We initiated the project on September 17, 2019, and distributed the survey on September 30, 2019. Data collection took place from September 30 to October 25, when the survey was closed at midnight. Over this period, we received 1,151 usable responses, of which 311 came from current GOV suppliers, 148 past GOV suppliers and 692 from non-GOV suppliers. From those responses, we identified several key insights:

What is important to suppliers?

The 21 attributes describing how suppliers viewed their customers were not equally important. Consequently, the first step was to determine what is important to the suppliers. To do so, we asked

TABLE 1

Consumer attractiveness attributes

ATTRIBUTE NAME	ATTRIBUTE DESCRIPTION
TRUST	Mutual trust and respect
PROFIT	Profitability of dealing with the customer
PROBLEMS	Joint problem solving
SIMPLERFP	Simple and complete Request for Quotation/Request for Proposals
TIMELYAWD	Timely awarding of contracts
CLARITY	Clarity of interactions
PREDREVNU	Predictability of revenue flow
CONFLICT	Effective conflict resolution systems
OVERALL	Overall ease of doing business
OPENNESS	Openness to suggestions and improvements from suppliers
EARLYWRN	Early warnings (regarding orders, problems, opportunities)
LTCOMMIT	Long-term commitment to suppliers
FREQCOMM	Frequency of communication (rather than only communication when there is a problem or a bid to be placed)
TRANSPART	Transparency of projects and purchases
PERMEAS	Effective, meaningful performance measures
MISSION	Clear mission and statement
CONSISTMESS	Consistency of messages/measures across levels and organizations
RISK	Risk sharing
INTEROP	Good interoperability (i.e., ability to link processes and share data).
SUPPLIERIMP	Programs for supplier improvement (in response to performance issues)
SUPPLIERDP	Supplier development programs

Source: Authors

respondents to evaluate the 21 attributes using a 5-point Likert-scale (1: not important at all to 5: critical/essential). The averages for these ratings are reported in Table 2.

More importantly, this table sorted the 21 attributes in importance, with the most important at the top and the least important at the bottom. The horizontal line found in Table 2 identifies those attributes that were most important (with an average rating at 4.0 or higher) from those that were not as important.

There is one more important feature of Table 2, it involves the third column “Sign.” This column reports the results of a simple statistical test—to what extent are the assessments generated by the third respondent groups (i.e., current suppliers, past suppliers and never have been suppliers) the same or different.

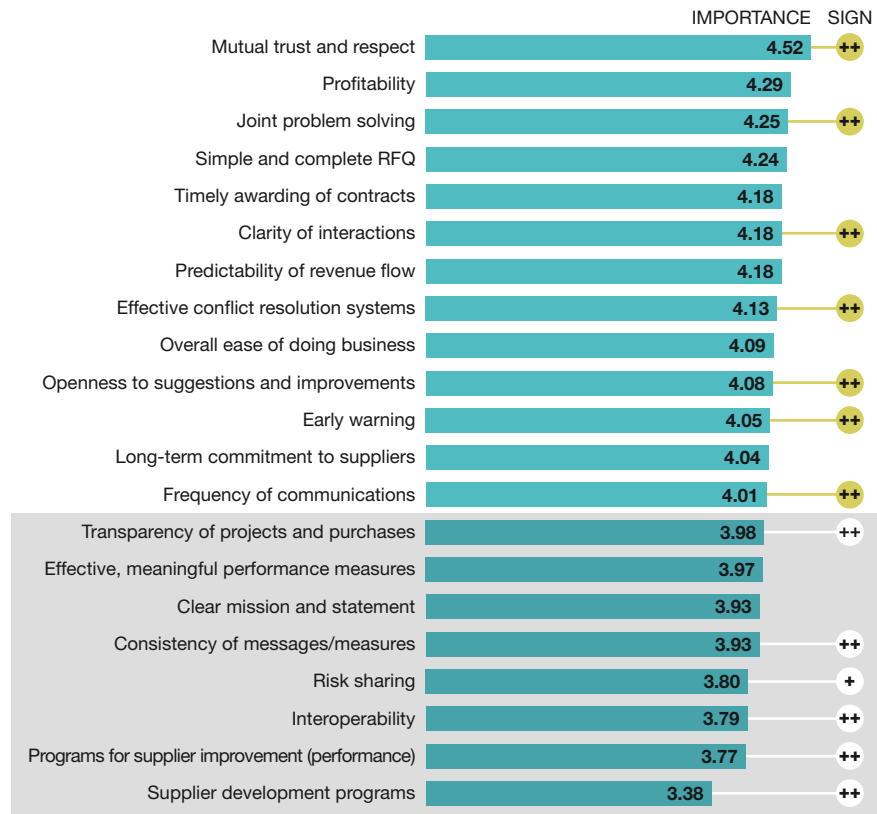
From Table 2, we drew the following conclusions.

- The respondents consider all attributes important. It is interesting to note that not one of the attributes was rated at 3.0 or less. Suppliers are apparently very demanding of what they want from customers in today’s supply chain.
- Suppliers who deal with the private sector only have higher expectations relative to those who currently worked with GOV or those who have worked with GOV in the past.

We can see from Table 2 that, out of 21 attributes,

TABLE 2

Consumer attractiveness attributes evaluated by suppliers
(Mean values)



Note: For SIGN (significance), ++ denotes that the differences between the groups is significant at the 0.05 level; + denotes that the differences are significant at the 0.10 level.

Source: Authors

significant differences were observed for 13 attributes. For each of these 13, the ratings generated by those who had never worked with GOV were consistently higher than those observed for the other two groups.

This data paints a picture of suppliers who are generally more demanding. They want more; they have been exposed to best practices in other industries and they use these experiences to shape their expectations of what they want from a customer.

Can we simplify the 21 attributes?

Before leaving the quantitative analysis, let’s discuss a major problem: Dealing with 21 different attributes is

complex, so can we simplify the 21 attributes? To address that issue, we used exploratory factor analysis to determine if there were hidden factors present in the 21 attributes. The results are summarized in Table 3.

TABLE 3

**Supplier base management
four pillars of success extracted factors**

RELATIONSHIP MANAGEMENT	COMMUNICATION FLOW	SUPPLIER COMMITMENT	TRANSACTION MANAGEMENT
<ul style="list-style-type: none"> • Problem solving • Conflict resolution • Clarity of objectives • Mutual trust and respect • Mission • Openness • Risk sharing 	<ul style="list-style-type: none"> • Performance measurement • Consistency of message • Transparency • Frequency of communication • Early warning 	<ul style="list-style-type: none"> • Supplier development • Long-term commitment • Interoperability • Supplier development (problem driven) 	<ul style="list-style-type: none"> • Timely awarding of contracts • Simple RFP • Predictable revenue • Overall ease of doing business • Profitability

Source: Authors

What this analysis tells us is that purchasing professionals should focus on four pillars if they want to be viewed as a “good” customer.

1. Improve the relationship management process. This is the ongoing process by which the government and its suppliers work with each other. This pillar recognizes that cooperation is necessary to deal with problems as they occur and to facilitate the generation and flow of ideas and suggestions between the government and its suppliers.

Suppliers are often intelligent and well-versed in their areas of expertise. They can identify potential problems at early stages of design—the best and most cost-effective place to introduce such suggestions. Yet, such relationships do not occur in a vacuum; for instance, they don’t occur when there is a strict “I am the buyer and I tell you what to do” environment. Rather, cooperative and effective relationships occur when there is mutual respect and trust; such relationships occur when there is openness and a willingness to consider new and different ideas.

2 Improve communication flows. Communication is an on-going affair; it is not limited to the announcement of a bid or when there is a problem. We recognize that it takes time for the supply chain and its elements to react

or change. That is why early warning is so important. Communication deals not only with complaints and problems; it also deals with recognition of jobs well done. To draw on a useful analogy, in marriage, the

top reason for couples breaking up is poor communication. A buyer-supplier relationship can be regarded as a form of marriage.

3. Increase the level of supplier commitment. Suppliers want to know that they are important to the buyer. One way that the buyer can communicate this importance as well as the implied worth of the

supplier is through supplier commitments.

This involves formal systems for developing and evaluating suppliers. These systems help the supplier understand what the requirements are to do a good job for the customer. In many cases, especially when dealing with small- to medium-sized enterprises (which are often informally run), buyers can help suppliers improve control over their processes by introducing them to such tools as process flow analysis, capacity management and lean tools. They can also help the supplier understand how to submit bids and how to bill. They also help the speed and ease with which the systems and processes of the suppliers and those of the government can be interfaced. As a customer, buyers must not only be willing to buy from its suppliers; it must be prepared to share them so that they are better suppliers.

4. Do a better job of managing the transaction or the buy. This final element is the most straightforward. It deals with revenues and costs. Because many suppliers working with GOV are SMEs, one challenge is that they lack the financial resources of large suppliers. Consequently, effective transaction management is very important to these suppliers.

This analysis also tells us which attributes contribute

to which specific pillar. Each pillar can be viewed as the result not of activities, but of processes. As Joseph Juran, one of the fathers of Total Quality Management once remarked: If you don't like the outcome(s), change the process(es). This statement is now referred to as "process thinking."

The takeaway is that any government agency, or private sector business, must evaluate the processes that are responsible for each pillar, identify the weaknesses and deficiencies present in each and improve these processes by attacking and eliminating these deficiencies.

While this is a major undertaking, the good news is that the tools, procedures and systems needed to achieve these improvements are present—they are found in most Total Quality Management systems.

One other takeaway: While the survey focused on government suppliers, we believe the insights are applicable to buyer-supplier relationships in other industries.

Is being a good customer enough?

In a word: No. To help managers achieve the objectives described in the preceding section, being a good customer has to be complemented by two other activities: prioritization and supplier development (see Figure 2).

These activities are too important to be discussed in a sentence (expect to see an article about them in

FIGURE 2
The foundations of modern strategic supply chain management



Source: Authors

About our research

Our study was initiated by a U.S. Federal agency that we refer to as GOV. Our research targeted primarily small- to medium-sized suppliers (SMEs), defined for our purposes as suppliers employing 500 or fewer employees. Completed over a three-month period, the study helped the researchers better understand the relationship between EPT and being a good customer. More importantly, it helped the team understand that being a good customer is not enough.

upcoming issues of SCMR). Taken together, earned preferential treatment, prioritization and supplier development form the foundation on which modern strategic supply chain management is built.

EPT at critical supply chain stages

EPT is an important component of every well-run supply chain. However, it is earned not by large volume purchases or by paying on time. Rather, it is earned by being a good customer. When you are a good customer, you build good supplier relationships. With EPT and good supplier relationships, you position your company to build a strategic supply chain.

However, EPT and good supplier relationships are only part of the answer. To be truly effective, these have to be paired with prioritization and supplier development. As our research demonstrates, EPT is what you get when you are a good customer to all tiers of the supply chain, and not simply Tier 1. ☺

To read more about the Working Relationship Index, see *Lost Supplier Trust, Lost Profits* (scmr.com/article/lost_supplier_trust_lost_profits) from the May 2014 issue of SCMR, and *How They Did It: Supplier Trust at GM* (scmr.com/article/how_they_did_it_supplier_trust_at_general_motors) from the May 2017 issue.

Which technologies will make your supply chain resilient?

In a world that defies prediction, a resilience stress test guides your priorities and investments.

By Suketu Gandhi and Alanna Klassen Jamjoum

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Companies have long followed a basic formula for delivering products on time and at the lowest cost: First, construct a highly detailed supply chain model, based on forecasted conditions and priorities over a three- to five-year span, and then execute against that predefined performance blueprint.

Prolonged trade wars and a devastating pandemic drove home the limitations of this approach, as global disruptions made it difficult (and at

times impossible) to execute against plans. Many companies are now embracing the imperative to build a more resilient supply chain that can absorb and rapidly adapt to unexpected shocks and make decisions in the execution window, as well as satisfy increasingly diverse and personalized customer demands.

The essence of such a supply chain is the ability to sense what's happening in the external environment and across one's own supply chain, while continuously pivoting in response. The goal is still to reliably deliver products on time, to the customer's complete satisfaction, at a highly competitive cost. But the approach is fundamentally different: it melds planning and execution into a simultaneous process. This is the only logical response to an operating environment that increasingly defies prediction.

Technology is clearly crucial to moving in this new direction. The open questions are: "What will it take to get there?" and "where do we start?"

Resilience stress test

To help C-suites shape actionable answers to these questions, Kearney created a resilience stress test (RST) that blends immediate and long-term perspectives to pinpoint your supply chain's vulnerabilities and surface your most compelling strategic opportunities.

This comprehensive scan assesses supply chain resilience across eight dimensions spanning a company's own processes, as well as those of suppliers and partners, all from the perspective of preparing to reliably and cost-competitively deliver superior customer value—even in the midst of disruption. Within that broader assessment, the RST closely examines which existing and emerging technologies are most vital to increasing your company's resilience. Specifically, we explore which technologies could most effectively enhance your ability to do the following.

Sense. Gather and interpret data that keeps you comprehensively informed about what’s happening, in as near to real time as possible, while efficiently surfacing the data that matters most.

Decide. Define the optimum blend of human and artificial intelligence (AI) to make better, faster choices based on the relevant data.

Pivot. Increase your operational ability to nimbly adapt to changing conditions with optimum effectiveness and efficiency.

A central purpose of the RST is to help C-suites move beyond sweeping (and often irrelevant) generalities about digital potential to focus on specific ways in which technology can enhance supply chain resilience—for example, technologies that enable you to crawl and analyze data in near real time; integrate complex internal/external data sets; and continually optimize your supply chain by making hundreds of millions of data-driven decisions each day.

The RST does this by offering objectively identified and strategically prioritized insights into the value that specific technologies might yield in the context of your company’s unique goals, supply chain strategy and structure and evolving operating environment. This level of specificity yields practical answers to the previously perplexing question: “Where do we start?”

Resilience technologies

As you might expect, the value potential of distinct technologies varies greatly in each RST we conduct, but here’s a sampling of digital advances likely to make your supply chain more agile and resilient.

Graph databases. Most companies now understand that graph databases offer the unprecedented ability to capture complex relationships in vast webs of information—internal, external, structured and unstructured—yet few have systematically explored where and how such revolutionary capability might best be applied to increase the adaptation, speed, differentiated customization and resilience of their own supply chain.

Analytics and AI. These are obviously essential technologies for extracting practical business value from the exponentially expanding body of available data. In supply chains, agility and resilience will come from using massive volumes of data to make not only

macro-strategic choices but also everyday micro-decisions, while ensuring those myriad decisions all mesh together. In conducting the RST, we’re finding that about 70 to 80 percent of identifiable decision points across a supply chain can and should be made by technology rather than by humans. Ramping up your use of decision-making technologies also lets you make decisions at a far more granular level, thus enabling very fine operational adjustments in real time and allowing you to offer increasingly nuanced solutions to customers.

Cognitive engine. Options are central to making supply chains more agile and resilient. Digital twins are a highly effective yet often underutilized way to simulate various supply chain configurations (for example, supplier networks, alternative materials, different cost scenarios) at a very detailed level, so you can try out new blends of processes, speeds and volumes before translating them into a physical production line.

Cloud. This may feel like a given, because the Cloud is increasingly synonymous with connectivity, but we find few companies have an exhaustive understanding of how they might apply that connectivity to make their supply chain effectively sense, decide and pivot in real time.

5G. The hype has long preceded the operational reality, but as 5G rolls out, the Internet of Things can capture crucial data from every micro node of your supply chain and relay it to you in real time. Sometime soon, not a sparrow might fall without you knowing. How are you preparing to make effective use of such granular and comprehensive knowledge?

Twin tensions

Every company feels the twin tensions of an increasingly unpredictable operating environment on the one hand and the exponential expansion of digital capability on the other. The RST translates those tensions into a clear plan of action, with objectively identified improvement priorities mapped against the specific technologies that will make your supply chain resilient.

However, whether you utilize a stress test from a firm like Kearney, or devise one of your own, determining the technologies that will enable you to sense and pivot is essential to supply chain success in our new operating environment. ∞∞

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In its latest “World Flash” intelligence report, IHS Markit economists note that as the dreaded second and third waves of COVID-19 arrived in late 2020, they crushed any illusion that the world could quickly and easily control the spread of the virus. The resurgence was especially pronounced in Europe and parts of the United States, where “pandemic fatigue” has become a formidable challenge for governments.

“Even before the most recent surge in infections, we were predicting that growth would fade in the closing months of 2020 and the beginning of 2021,” says Nari-man Behravesh, chief economist for IHS Markit. “That fade is morphing into something worse. In the case of the Eurozone and the UK, real GDP will contract in the fourth quarter of 2020, and recovery will be limited in the first quarter of 2021.”

However, prospects are a little less dire for the U.S. economy, IHS economists maintain. After the United States grows an expected 3.7% in the fourth quarter of 2020, average growth in the four quarters of 2021

should be a mere 1.9%. The outlook is brighter in much of Asia, where the infection rates have remained low.

Other mainstream economists and multilateral organizations—such as the International Monetary Fund—are calling for more fiscal stimulus as the need to strengthen struggling economies has overwhelmed notions of austerity. Furthermore, with institutional and political constraints in Europe and the possibility of a divided government in the United States, more limitations on budgetary expansion in the emerging world mean hopes for big fiscal stimulus are dashed or fading fast.

Meanwhile, central banks will continue to bear the burden of stimulus, IHS economists contend. Despite repeated pronouncements to the contrary, monetary authorities around the world are not in retreat, as was amply demonstrated during the 2008–2009 global financial crisis. “The bottom line is that, once again, the near-term global economic outlook has worsened, and the most likely policy mix looks to be suboptimal,” concludes Behravesh.

2021 RATE OUTLOOK: HIGHER RATES dead ahead

Freight transportation providers responded to COVID-19 pressures heroically, becoming leaner, more collaborative and efficient. And while this is good news for the nation's freight network, shippers should expect significantly higher rates across all modes in the months ahead as the world moves through recovery.

BY PATRICK BURNSON, DIGITAL EDITOR

Energy enigma

Within this context, no discussion of freight transportation costs can be understood without first looking at the energy picture. Derik Andreoli, principal at Mercator International and a frequent contributor to *Logistics Management*, says that it looks like we'll enter 2021 with "significant headwinds" that will continue to suppress oil demand and prices.

Andreoli maintains that oil demand is on track to decline by between 8.5 million barrels per day and 9.0 million barrels per day, while domestic production will likely continue to dip at least through the first half of 2021, as the global economy is expected to continue to struggle with new waves of virus infections.

"The U.S. Energy Information Agency predicts that demand will only grow by 5.9 million barrels per day in the coming year, which will leave global demand around 3 million barrels per day below 2019 levels," says Andreoli. "And for this reason, we should expect to see oil prices continue to remain low, though uncertainty

around the continued collective determination among OPEC members to maintain production cuts is likely to cause price volatility."

Andreoli adds that this volatility could be intensified by a "global geopolitical reset" that could come about as a result of change in U.S. leadership. "It's unclear how eager President Biden will be to re-engage Iran with a new nuclear deal, resulting in increased Iranian oil production," he says. "Meanwhile, the entire Middle East region—which has seen four historic peace deals brokered in recent months—could destabilize."

For these reasons, says Andreoli, logistics managers should expect crude oil prices to be volatile throughout the coming year. "But most needles point to persistently low oil prices, and this should translate to low fuel prices," he concludes.

Ocean: "Stratospheric" spot pricing

Despite a softening of energy prices, shippers may expect a sustainable hike in ocean cargo rates, says Philip Damas, director and head of the supply chain advisors practice at

London-based Drewry. “Manufacturers and retailers should expect ocean contract freight rates on most routes to increase in 2021, following major market changes since the COVID-19 outbreak,” he declares.

Damas adds that signs are obvious in the spot market for ocean transportation that carriers have gained pricing power and are managing ship capacity to their advantage. “Some routes and regions stand out as benefiting from lower rates, but the vast majority are

After the U.S. grows an expected 3.7% in the fourth quarter of 2020, average growth in the four quarters of 2021 should be a mere 1.9%. The outlook is brighter in much of Asia, where the infection rates have remained low.

—IHS Markit

seeing rates rise—particularly trans-Pacific eastbound—where the increases are worryingly high for shippers and the rates are much more profitable for ocean carriers,” he says.

The “stratospheric” increases in trans-Pacific spot rates and the current shortage of capacity in Asia have led regulators in China and the U.S. to signal that they’re watching the competition situation closely, observes Damas. China’s Ministry of Transport met with most major carriers late last year, requesting that carriers bring back more ship capacity to the market.

At the same time, the U.S. Federal Maritime Commission said that it’s “actively monitoring” any potential effect on freight rates and transportation service levels, using a variety of sources and markers, including the exhaustive information that parties to a carrier agreement must file with the agency.

“Particularly this year, shippers and forwarders should track the development of spot freight rates because

they signal the tightness of the market on some routes,” adds Damas. “They may be a leading indicator of contract rates, and could point to future problems of capacity availability.”

Trucking: Rates jumping

The domestic surface transportation industry is also poised to take advantage of spot pricing and capacity management, says David Ross, transportation analyst at Stifel Investment Banking.

He advises logistics managers to

begin analyzing truckload (TL) pricing because it has implications for less-than-truckload (LTL) and intermodal as well—and it’s by far the largest market in domestic freight transportation.

“It has been a wild ride this year, but after a shaky start, the trucking market has been a good one for carriers since June, with spot rates rising each month the last couple of quarters,” says Ross. “Contract negotiations will lag, but the industry pricing has already been reset higher. Driving these increases has been the combination of reduced industry supply—fewer drivers and fewer trucks—and improving and steady demand after we emerged from the lockdowns.”

Looking to 2021, Ross doesn’t see the supply issues being quickly resolved. However, the bigger swing factor will likely be overall consumer demand. Still, he sees rate increases up in the high single digits in 2021 versus 2020 on the contract side.

Meanwhile, with a positive backdrop provided by the TL capacity issues,

Ross says he sees no reason why LTL can’t continue its steady push of low-to mid-single digit rate increases. “It doesn’t need as much, because LTL is a more consolidated industry with steadier annual price adjustments, but we expect the carriers to take advantage of the rising tide and push closer to 5% than 3% for rate increases in 2021,” he concludes.

Rail and intermodal: Steep climb ahead

Navigating the road to post-pandemic normalcy will be a major challenge for rail and intermodal operators, says Jason Kuehn, vice president of the consultancy Oliver Wyman. He adds that third quarter 2020 rail traffic data can be described as nothing short of resilient overall, with a handful of exceptions in the bulk commodity areas comprising coal, non-metallic minerals, metallic ores and metals, and petroleum.

“Intermodal volumes have climbed above 2019 weekly counts in the third quarter and remain there in the first half of fourth quarter,” says Kuehn. “A relatively strong consumer market and very constrained truck capacity have been tailwinds for domestic intermodal rates and volumes. In the meantime, a surge of imports from overseas for replenishing inventories coupled with the normal peak for the Christmas shopping season have tested both truck and intermodal capacity at times.”

At the same time, spot truck rates are up considerably. And while this bodes well for first quarter 2021 contract renewals and rate increases, the long-term outlook for intermodal and rail in general is still dependent on longer-term, secular trends and disruptive shifts in supply chains and the trucking sector.

The carload business—excepting the

bulk commodities—has also rebounded, albeit at a much slower pace than intermodal. This also potentially sets up a relatively strong pricing environment for this line of business going into 2021. Much of this business is housing related or intermediate goods—inbound raw materials—for the consumer space.

The heavy industrial sector—energy and metals—remains weak, and for Kuehn, this suggests that “caution is a better emotion than euphoria.” Market uncertainty is keeping metallic and non-metallic ores and metals depressed. “This all suggests that, while the environment is robust now, we expect at best a plateau and at worst some returning weakness in 2021,” he adds.

Air & parcel: Could be a bumpy ride

For Chuck Clowdis, managing director at the consulting firm Trans-Logistics Group, Inc. the coming year brings even more uncertainties than usual for the air cargo sector.

“Consumer spending will certainly be a driver of air cargo volumes and higher rates,” says Clowdis. “Manufacturing, as demonstrated by auto sales, is also a beneficiary of consumer confidence and spending. Consumer and home improvement items have likewise translated into more demand for airfreight than anticipated.”

Furthermore, says Clowdis, COVID-19 vaccines and treatment drugs will buoy demand for airfreight capacity, while new cell phones and tablets will generate more business for consolidators. “Rates are already rising and will continue should there be changes in import/export regulations, especially in the international air space,” he says. “Express and regional service carriers will benefit as early vaccines become available and more pressure comes from every community for access to these

drugs—and rates will rise accordingly.”

However, available capacity will remain a question mark. With parked freighters and cargo conversions now entering the market, ongoing pandemic concerns will have an impact

“We should expect to see oil prices continue to remain low, though uncertainty around the continued collective determination among OPEC members to maintain production cuts is likely to cause price volatility.”

—Derik Andreoli, *Mercator International*

on crew capabilities as dedicated freighter capacity continues to grow, Clowdis maintains.

“Conversely as passenger flights are canceled, belly space on passenger flights drops,” says Clowdis. “Loss of this capacity to even mid-sized communities can have dramatic impact on shipments. As example, Delta and American have also announced cuts of more than 100,000 flights due to low demand in December,” he says. “A combination of ongoing epidemic fears and belt-tightening by consumers in 2021 may give air cargo providers a prolonged, bumpy ride.”

Similar turbulence is expected to confront logistics managers in the parcel sector, says Jerry Hempstead, principal of Hempstead Consulting. In particular, “peak season fees” were plugged in as capacity across the oceans diminished due to the cancellation of passenger flights. In turn, many air carriers had a lot of cargo below deck, keeping air cargo rates stable.

“Sheltering in place during the lockdown caused us all to begin procuring everything under the sun, and peak season was almost all year in 2020,” says Hempstead. “We’re now we seeing peak on peak fees.” Exacerbating that reality was the fact that some shippers were told that there would be volume limits

on how many transactions they can tender to the carrier during the “shipathon” between Thanksgiving and Christmas.

“This is a new phenomenon for the parcel industry,” says Hempstead. “The UPS strike of 1997 might have given

us a glimpse, but this is new territory. The problem for the carriers will be the decision making on capital expense. Do they add capacity for what may be a temporary windfall? Or do they just sweat the resources they already have in their networks and deal with the service complaints later?”

Hempstead adds that UPS has had a 6% late payment fee for some time, which is a key driver of revenue for them. FedEx will be employing the same strategy in January, which means that logistics managers may be seeing bills with 6% added to balances over 14-days outstanding.

“This is not going to be appreciated by accounts payable,” says Hempstead. “And it will leave shippers wondering why their projections were off.” He advises logistics managers to either figure out what’s driving their costs with the parcel carriers, or hire a professional.

“If you have a freight audit and payment service, make sure they understand the ramifications of not paying within term and hold them accountable,” adds Hempstead. “Know that the terms and the percentages charged are negotiable.” ☞

Patrick Burnson is the digital editor of Supply Chain Management Review

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SUPPLY CHAIN REDESIGN EXPECTING THE UNEXPECTED

The top trends driving supply chain design decisions for the coming year—and beyond.

BY BRIDGET McCREA, CONTRIBUTING EDITOR

The global pandemic left some global supply chains in shambles and others looking like the stars of the show. Many companies found themselves somewhere between these two extremes, somewhat satisfied with how their supply chains performed in 2020, but ready to make changes for the new year.

Concurrently, companies were grappling with higher e-commerce order volumes, an uncertain global tariff environment, a tumultuous political environment and stiff competition for both labor and warehousing space. To overcome these issues, supply chain managers more carefully pondered how their people, processes and technology converged to create effective supply chain networks.

In certain cases, companies were forced to tear down the walls of their current networks and develop entirely new approaches that they wouldn't have considered just two years ago. Immediate reactions included reshoring manufacturing operations to the United States, seeking out new, non-Chinese sources of supply, transforming physical stores into full-blown delivery hubs and investing in more technology and automation.

With the pandemic entering year two, companies are retracing the steps they took in 2020 and finding more enduring ways to shore up their supply chains not only for the pandemic, but also with a longer-term view in mind. For some, this means taking a close look at e-commerce volumes and trying to figure out just how long the current "spike" will last, and how much it will recede once customers can feel safe returning to their favorite brick-and-mortar stores.

"Different sectors are going to experience different movements in terms of what percentage of sales are generated by D2C/online sales versus brick-and-mortar," explains Bryan Jensen, chairman and executive vice president at St. Onge Company. "Even pure e-commerce businesses may experience a decline in sales as people go back to shopping at their local stores which, once reopened safely, may take sales away from online-only businesses."

This and other high-level shifts will directly affect the supply chain as it moves goods from the raw material stage and out into customers' hands. Jensen warns companies that those "hands"—which moved pretty quickly when COVID-19 hit—will be moving again in the near future.

"Some customers will be going back to stores and others will want deliveries made somewhere other than home as employees return to the workplace," Jensen predicts. "To adapt, supply chain managers should keep an eye on just how much that needle is shifting and then adjust appropriately while keeping their points of customer supply—be it a fulfillment center or storefront—appropriately stocked."

Facing the forces of change

Right now, companies are holding their collective breath

and waiting to see what impacts the new U.S. presidential administration, global tariff situation, Brexit and other forces will have on supply chains this year. They're also paying attention to the global pandemic and the worldwide vaccine rollout, knowing that these overarching factors may have an impact on their supply chain design strategies in 2021.

Following are five more forces of change that are affecting supply chain design and prompting organizations to rethink how they run their global supply chains.

1. Geopolitical disruption and uncertainty abound. Deep in the throes of pandemic-driven supply chain disruption, companies found themselves wading through a contentious national election environment, uncertainty over global tariffs and Brexit. The latter threw the UK's transportation environment into turmoil as trucks were stacked up at the country's border and as major freight providers halted service until the situation was ironed out. Jensen tells companies to expect more of the same at least through the first half of the year, although there could be some tariff relief ahead. "Before midyear, companies should at least have a vision of where the new administration stands on global tariffs," he says, "and how they affect overseas sourcing and importing." On a positive note, Jensen says some companies are benefitting from the incentives of sourcing locally within the United States, although he adds that "there appears to be some wait-and-see on that point right now."

2. China Plus One and other strategic moves. When the industrial city of Wuhan, China became the epicenter for the coronavirus in late 2019, companies and supply chains worldwide were hit hard. As the city moved into recovery mode, and as manufacturing spun back up, a lot of companies started looking around at alternate sources of supply. Some adopted a strategy now known as China Plus One by maintaining their presences in China while also diversifying into at least one additional country. Rosemary Coates, executive director of the Reshoring Institute, expects this trend to continue as companies try to avoid repeating the experiences of 2020. "Those disruptions opened a lot of eyes at the executive level," says Coates, "where not

everyone understood just how much risk and vulnerability existed in their supply chains.” Along with the China Plus One approach, companies are reshoring and near-shoring their operations in order to get more control over their supply chain operations. “For many companies, reshoring has become a very real and recognizable item on executive agendas,” she adds.

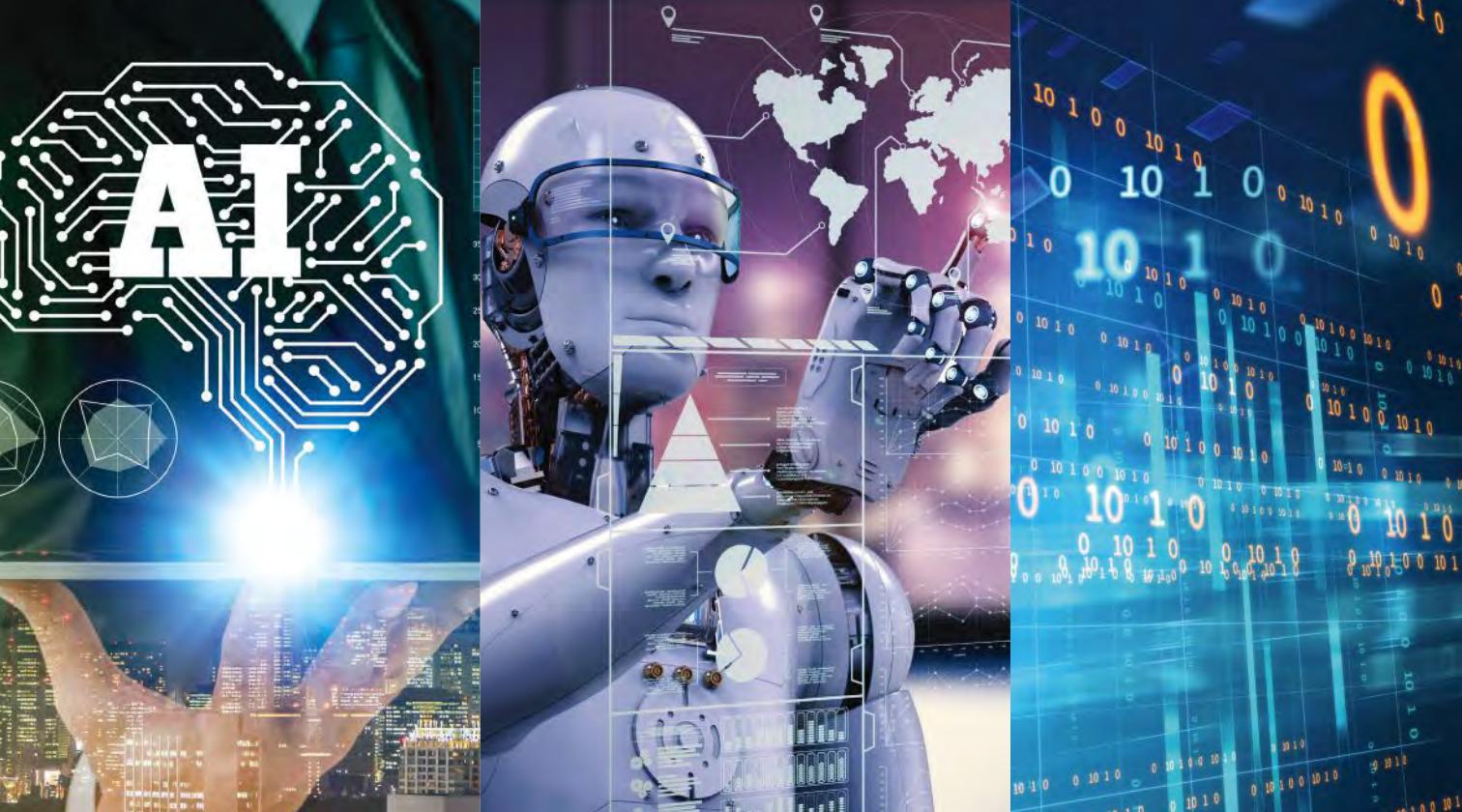
3. *Balancing cost, service and profitability.* After experiencing the 10-year period of economic expansion that followed the Great Recession, many companies were thrown into a tailspin when the global pandemic emerged during the first quarter of 2020. And while an economic downturn was probably in the cards anyway, based on the cyclical nature of the economy, few would have predicted the swift and merciless impacts of a pandemic. To adapt, many organizations revamped their delivery operations to focus on customers who began working, shopping and teaching their children from home seemingly overnight. Concurrently, demand for essential goods went through the roof, leaving companies scrambling to shore up their upstream supply chain operations. Through it all, organizations got a quick lesson in how to balance cost, service and profitability in a challenging environment. Carrying those lessons learned into 2021, companies also realize that there are a lot of tradeoffs when you’re working in a dynamic, uncertain operating environment. “Companies are more closely examining their supply chain and customer experience data,” says Darren Jorgenson, practice leader of the strategy team at Fortna, “and figuring out what they have within their control to be able to improve that experience and meet their customers’ needs.” In response, some companies are converting a portion of their physical store space into micro-fulfillment operations dedicated to buy online/pickup in-store (BOPUS). “Others are picking up now-empty retail space and using it to get their fulfillment operations closer to the end customers,” he continues. “Finally, this trend is being accelerated by the deployment of more flexible solutions, robotics and AMRs at the fulfillment level.”

4. *Leveraging advanced tech to improve resilience.* The volatility and shifts in consumer behavior as the global pandemic emerged and took hold made

predicting demand almost impossible. As panic-buying ensued, Gary Barraco, E2open’s senior director of product marketing, says forecasting errors spiked to levels almost 45% higher than their pre-pandemic baselines. Things leveled out about halfway through the initial response phase to create a “new normal” that was nearly 30% higher than the pre-pandemic error levels. “In short, the effect of the pandemic was to make it 30% harder to forecast than it was the previous year,” he adds. By combining that now-historical data (that companies previously lacked) with artificial intelligence (AI), companies can design their supply chains to withstand future shocks and disruptions, all in the name of creating more resilient networks. “Combining AI with real-time data can help organizations sense disruptions and predict what’s going to happen,” says Barraco, “and then create a forecast that reflects the current realities and act on that without the need for human intervention.”

5. *Preparing for more macro and micro shifts.*

Any company that didn’t already put its customers at the center of every supply chain decision found itself in a real predicament in 2020, when those buyers’ habits and preferences shifted wildly as the year progressed. Now, more companies are redesigning their supply chains with their customers front-and-center, knowing that both B2C and B2B buyers have the upper hand when it comes to vendor selection, cost, and shipping preferences (among other things). To compete effectively, Jorgensen says supply chain managers have to ask themselves questions like: What are our customers’ expectations? How does our supply chain measure up, based on those expectations? And, what actions can we take or what trade-offs can we make to improve upon that? Involve the C-Suite in these discussions, Jorgensen advises, and then use the input to make good investments in technology, processes and/or people. “There are multiple different pivot points coming—both at a macro and micro level,” he adds. “Sure, we know that e-commerce will continue to grow, but apart from that the certainties are very few right now. Your best bet is to focus on shorter-term investments and on building flexibility and adaptability into your solutions.” ☞☞



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What supply chain leaders need to know about virtual collaboration

The shift to remote work and virtual collaboration was abrupt, but it's likely to endure.

By Marisa Brown, senior principal research lead, Supply Chain, APQC

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Collaboration has always been integral to supply chain management success. Supply chain professionals must collaborate and share information with internal stakeholders across functions to achieve organizational goals. They must also build and maintain close relationships with a variety of external partners including suppliers, logistics providers and customers.

When the COVID-19 pandemic hit, almost all forms of organizational collaboration, including supply chain collaboration, went virtual.

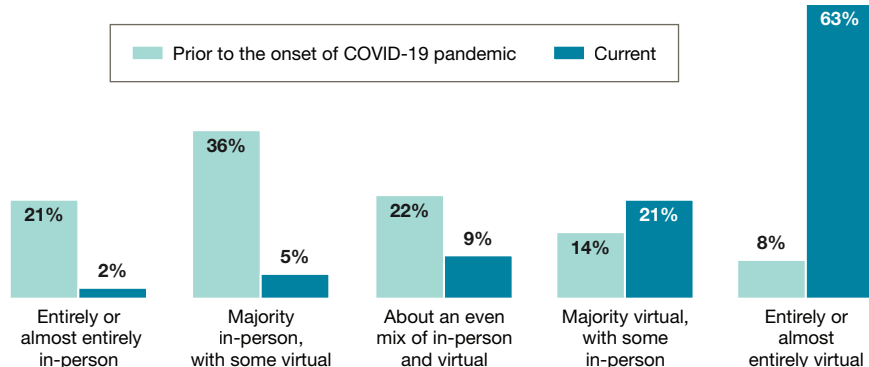
Although the shift to remote work and virtual collaboration was abrupt, it's likely to endure as organizations have already realized significant benefits in terms of costs, productivity and risk management.

In this article, we will look at the current state of virtual collaboration, what it means for supply chain management and five keys to ensuring successful and sustainable virtual collaboration in 2021.

The current state

We all know how big the shift to virtual work felt within our own organizations, but APQC's "Virtual Collaboration: Rules of the Road" research conducted in the fall of 2020 shows just how drastic it was. Before COVID-19, 57% of survey respondents interacted with coworkers primarily in person. In the aftermath of the pandemic, 84% said their coworker interactions were primarily virtual (Figure 1).

FIGURE 1
Interactions with coworkers



Source: APQC

The move to virtual and hybrid work is not a flash in the pan. Many organizations have given up their office leases or moved to shorter and more flexible terms. Millions of newly remote employees have relocated from expensive, close-to-work cities to more affordable suburbs and small towns. That both executives and employees are making such big moves suggests that virtual work is here to stay.

Indeed, while APQC's research identified some important challenges with virtual work, 75% of respondents said that they are satisfied overall with the current state of virtual collaboration in the workplace. When APQC asked about the biggest benefits of virtual collaboration, 65% of respondents said that they appreciate the time they save commuting and traveling. Other top benefits revolve around efficiency: People said that discussions are more to-the-point and they can get work done faster.

However, it's also clear that virtual collaboration works better for some things than it does for others. Respondents said they're struggling to use virtual tools for more creative, complex forms of collaboration such as innovation and problem solving. And when it comes to collaborative activities that require trust and social capital, such as change management and team building, virtual isn't working as well as face-to-face once did. In a virtual setting, it's hard to replicate unstructured and serendipitous exchanges—or in other words, to recreate the conversations that used to happen around the watercooler.

Many employees are frustrated with the lack of guidance and ground rules around virtual collaboration. Survey respondents pointed to the following problems:

- a lack of sufficient norms and policies to guide virtual collaboration;
- too many overlapping or disconnected apps or platforms; and
- insufficient training on how to collaborate virtually.

More than half of respondents said that their organization either has no guidelines for virtual collaboration or that norms emerge ad hoc as groups work together. APQC also found that when organizations do have guidelines, the communication around them is mostly reactive rather than proactive. Thus, while people say they're satisfied with virtual collaboration now, some big problems are brewing. If this is to be a longer-term change, organizations can't keep treating it

like a stopgap measure that was thrown together in a crisis.

Supply chain implications

Supply chain management discussions about collaboration tend to focus on external collaboration. In 2020, that focus was perhaps even stronger as supply chain professionals leveraged their external partners to help navigate supply shocks and overloaded transport systems. External collaboration will remain vital in 2021, but supply chain professionals must also take a close look at their internal collaboration practices this year.

APQC finds that strong, sustainable collaboration builds from the inside out. Organizations must first develop an internal culture of collaboration before extending the effort to include partners. For supply chain, this is particularly important as maintaining mutually beneficially relationships ensures processes are not interrupted. Creating and maintaining a collaborative culture requires deliberate decisions about how and when employees will collaborate as well as what guidelines and norms they will follow. In 2020, these deliberate decisions, guidelines and norms were often lacking. Organizations can be forgiven for deploying ad hoc approaches in such a chaotic time, but this year must be better.

5 keys to success and sustainability

Supply chain organizations can fix current-state pain points and lay the groundwork for more successful, sustainable virtual collaboration. These are levers that can and should be pulled by all levels of management. Chief supply chain officers and VPs of sourcing and procurement, logistics, distribution and other executives should provide senior-level advocacy for these changes—but managers must help disseminate them and model desired behaviors.

Make virtual meetings limited and purposeful. Employees have experienced a dramatic upsurge in the number of virtual meetings. APQC's research found that virtual meetings, both video calls and audio meetings with screen sharing, became significantly more critical in the wake of the pandemic. In a remote or hybrid workplace, video meetings are key to getting work done, building and maintaining relationships and obtaining information and expertise.

Despite how important virtual meetings are,

few organizations have clear guidelines around them. Only 8% of organizations have limits on the number of meetings or their frequency, and only 35% have established criteria for meetings (e.g., requirements to share agendas ahead of time). Here are six steps for improving virtual meetings.

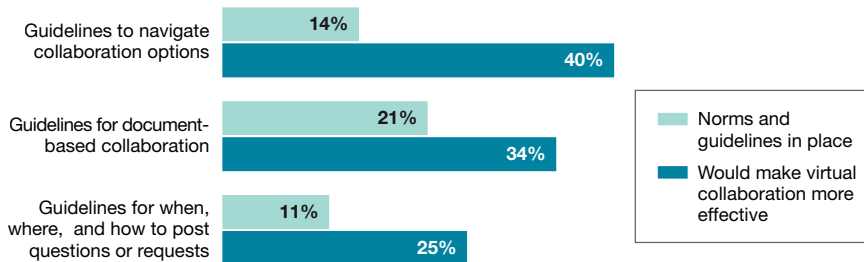
1. *Avoid making meetings the default form of communication.* Use chat and email when possible, saving virtual meetings for when more immediate or deeper interaction is needed.
2. *Replace big, long meetings with smaller, shorter ones.* When possible, have check-ins with individuals and small teams instead of calling everyone to a single “all-hands” meeting.
3. *Use video but allow for breaks.* Ask participants to turn on cameras at the beginning and during discussions but allow people to turn cameras off when they’re not speaking.
4. *Require invites to include objectives and an agenda.* If organizers send out agendas ahead of time, employees will have the information they need to decide whether to accept the invite.
5. *Empower people to decline if they don’t need to be there.* In most organizations, it’s easy for any

rating team and project sites as highly critical to work. However, we did not see the same upsurge in cross-boundary collaboration. Employees are working virtually but still relying on the networks they built in the physical office.

One effective method to encourage deeper, more complex forms of collaboration—such as brainstorming and innovation—is communities of practice. Communities of practice are fluid networks of cross-functional people who come together to share, discuss and learn from each other around a common discipline or topic of interest. They’re a great place for employees to build their networks and participate in unstructured yet focused discussions around work-related topics.

Streamline options—and clarify what happens where. APQC found that people really want guidelines around when, where and how to use virtual collaboration tools. They want to understand which apps to use, how to decide between different options and channels, how to collaborate on documents and where to put questions and requests (Figure 2).

FIGURE 2
Guidelines: What’s in place vs. what people want



Source: APQC

employee to invite anyone to a meeting at any time. Management needs to set the expectation that it’s okay to decline to attend unnecessary meetings.

6. *Emphasize that necessary meetings require full attention.* Employees will be less tempted to multitask when meetings are shorter, more focused and less frequent.

Get people outside their bubbles. APQC identified a massive upswing in team-based virtual collaboration in 2020, with 59% of people

Employees also want limits on virtual groups and channels. In most organizations, anyone can create a new group or add someone to a group with a touch of a button. That might sound empowering and exciting, but over time, it becomes exhausting as employees struggle to keep up with all their groups and remember which discussions happened where.

Establish norms and guidelines. In a physical office, managers visibly model collaboration

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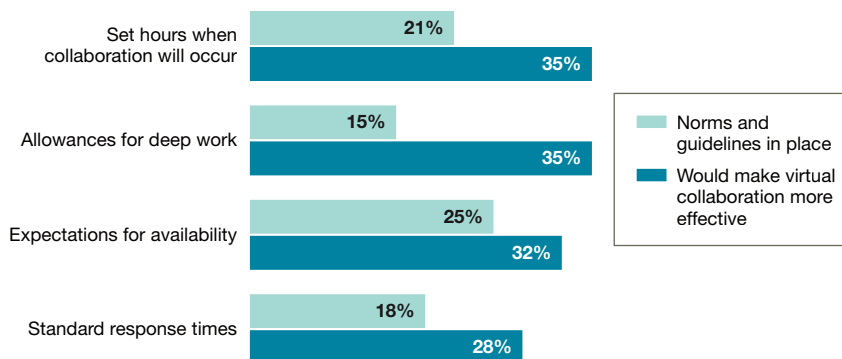
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norms and set the tone for how employees should (and should not) speak to each other. But many managers are not doing this in the virtual workplace. As a result, employees are making up the rules as they go, taking it upon themselves to self-police the virtual environment. This might be okay in the short-term, but it's not sustainable. In

satisfaction. Setting boundaries at the organization, function and department level, often differentiated by role, can help address this. Managers should clarify and reinforce expectations for each employee and help identify the best-fit ways for employees to mark off time for their most important work.

FIGURE 3

Boundaries: What's in place vs. what people want



Source: APQC

fact, the *New York Times* reports that “Office conversation at some companies is starting to look as unruly as conversation on the Internet,” complete with off-color remarks, political debates and cyber bullying. Five tips for bringing order to the current state of chaos include:

1. *Set clear rules and expectations, including a code of conduct, for the virtual workplace.*
2. *Involve people-oriented functions (like HR) in aligning expectations with organizational policies and procedures.*
3. *Create targeted training for leaders and managers so they can effectively model and reinforce behaviors.*
4. *Find ways to recognize employees for exhibiting desired behavior.*
5. *Provide a path to escalate serious issues such as cyber bullying.*

Empower people to set boundaries for collaborative time. APQC found that many employees want boundaries around when virtual collaboration will and will not occur, but few organizations currently provide them (Figure 3).

APQC also found that the lack of boundaries is taking a toll on employee productivity and

Key takeaways

Setting clear guidelines and ground rules is key to building a sustainable, successful collaborative culture in a virtual context. It's especially important for supply chain professionals to get this right, as mistakes and frustrations with internal collaboration can easily spill over into collaboration with suppliers and other external partners.

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