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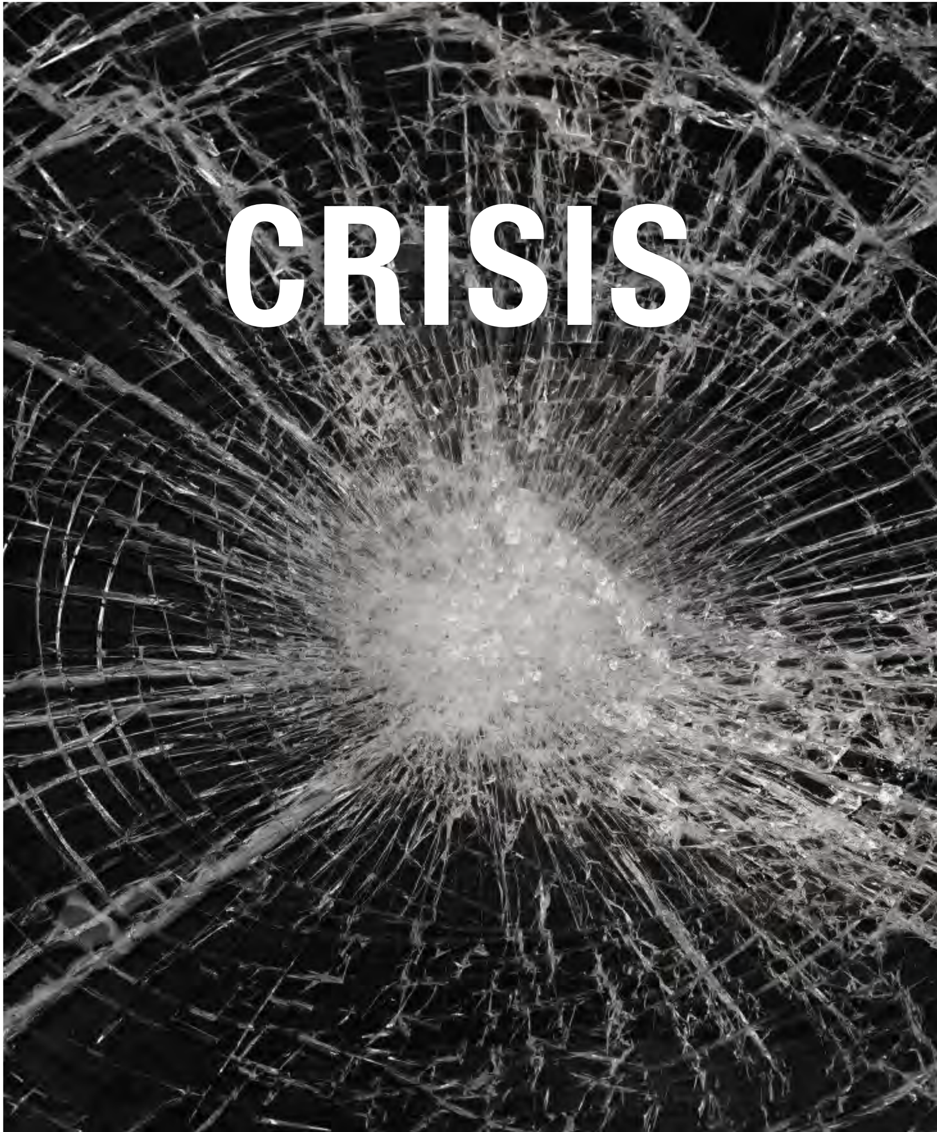

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Crisis

Bob Trebilcock, Editorial Director
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Most of the time, when I sit down to write this column I look at what I wrote for the previous year's issue for perspective or inspiration. The truth is, nothing I've written before, or experienced in my 64 years, has prepared me for COVID-19. I'm sure that most, if not all, of you can say the same.

Yes, it's a global crisis, but closer to home, it's a supply chain crisis. Quite simply, even the best supply chains, at least those that are still operating, are broken. I realized this when I recently placed an order with a national retail chain. I usually shop at their local brick and mortar store, but on those occasions when I do order online, it's not uncommon for me to get my order the next day. That's because their regional distribution center is less than 100 miles from my New Hampshire home. On the day I placed my order for an HDMI splitter for the TV, the anticipated delivery time was two weeks. Actual delivery time was 10 days, and it arrived without the power cord that I needed to make it work.

I wasn't upset. I get it. They're operating that DC with at least one arm tied behind their backs and this wasn't a matter of life and death—or toilet paper. But an article in today's *Wall Street Journal* noted that even Amazon has been struggling to make good on delivery times for Prime customers and wondered if disillusioned customers would begin shopping elsewhere when this is all behind us. I think the larger point is that many firms have become so good at managing their supply chains that consumers take speedy and accurate delivery as a given and what we do as an afterthought. COVID-19, on the other hand, has thrust supply chain management in the spotlight because we are stretched and stressed.

The question right now is: What lessons can we learn from prior supply chain crises (even if they weren't of this magnitude) that might help us going forward once we're no longer just putting out fires? There are no easy answers to that question, just as there are no easy answers to how we put this in the rearview and restoke the economy. But I trust that the thought-providing articles in this issue will give you and your organization some ideas once you restart our engines.

One final note. In light of COVID-19, we have rescheduled the NextGen Supply Chain conference at the Chicago Athletic Association for November 2-4, 2020. We have a great lineup, focused on how emerging technologies like AI, robotics and digital transformation, are changing supply chains. I believe that automation technologies are going to be more important than ever going forward. I hope you can join us. You can learn more about the conference at nextgensupplychainconference.com.

Bob Trebilcock

SUPPLYCHAIN MANAGEMENT REVIEW

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Remember the Great Recession? More than 10 years later, are supply chains better prepared now than in 2007?

24 Recession Readiness 2020: Did we learn anything?
The laws of gravity still apply: What goes up will come down. Yet time and again, a strong business cycle and fading memories convince us the good times will go on forever. We surveyed 100 manufacturing firms to find out if businesses are ready to fight through the next recession.

30 Five lessons for supply chains from the Financial Crisis
For many supply chain executives, the Financial Crisis was one of the toughest challenges of their careers. Firms across industries were required to deal with huge demand-supply mismatches caused by collapsing demand. However, the supply chain community found innovative ways to deal with the challenges of these tough times. Here are five lessons from that crisis.

38 Negotiating the economic downturn
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 BY LARRY LAPIDE

What about business downturns? Part 1

This "Insights" column is the first of a two-part series and deals with potential ways to forecast and plan major turning points—and get all-important organizational support for them. It is a slight revision of one written nearly 20 years ago in the Journal of Business Forecasting (JBF),* *that I recently reprinted in its Spring 2020 issue. I revised it in March before the COVID-19 virus impact truly hit the U.S. economy. At that time, I felt it was relevant for today's managers because the United States had experienced a long-running period of economic growth and pundits were speculating about an economic downturn. For too long managers had a relatively easy job forecasting and planning for continual growth. The next column will deal with selling and surviving in an organization living through a "bad news scenario" for the year.*

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

I was a business forecaster for five years. At the risk of boasting, I had a pretty good track record in forecast accuracy. However, most of that time I was dealing with a growth business that did not vary much because there was a lot of repeat business each year. Interestingly, I consider my best forecasting year to be the one that had the worst forecast accuracy. Here's why.

In that year, revenues took a downturn and turned from growing to declining. And while I was less than perfect—I forecasted flat revenue growth after many years of growth—I caught a turning point in the business, and that was more important than forecast accuracy. Indeed, the mark of a good forecaster is whether he or she is able to project a drastic shift in the business climate because catching a turning point in a business is important for all of a company's planning activities.

If the pundits are right about an impending economic downturn, these might be times that truly test the mettle of forecasters and planners. So, I'm dedicating this column to offering advice on how to forecast a turning point in your company's business—both in terms of methods to identify it and advice on getting organizational buy-in, so that people believe in it enough to incorporate it into their planning.

Ways to forecast a turning point

In contrast to forecasting constant growth, or for that matter even a declining business climate, forecasting a turning point requires a greater understanding of what is really driving a business. In a constant growth environment, you can't be too far off, nor have a significant adverse effect on operational planning activities, by only extrapolating trends from historical data. In order to forecast a drastic shift in a business, such as from growth to decline and vice versa, you require knowledge of what is going to make it so. That is, what factors will drive the drastic business change?

There are at least four methods that can be used to identify turning points.

1. Leading indicators. The best method for identifying when a turning point might occur in a business are leading factors that affect the future. Often these are economic or demographic in nature. For example, a decline in corporate capital spending might affect future consumer purchases as companies downsize to adjust costs to revenues. Also, trends on age and birth rates might indicate future declines in school populations, affecting back-to-school spending. These types of leading indicators are extremely useful if you are lucky enough to find them because cause-effect forecasting methods can be used to

project future turning points. For example, as I write this column, the current economic downturn is being caused by the impact of the COVID-19 virus' penetration in the population, as well as the various medical and mitigation actions being taken to contain it. Forecasting will depend on trying to understand their impact on the economy and the economy's impact on a company's customer demand.

2. Econometrics. The next useful method involves the use of economic projections to forecast business shifts. While similar to leading indicators, this approach differs in that the economic factors are not leading indicators, but are actually responsible for business changes—such as in the demand for luxury items that are bought with a consumer's disposable income, or for the materials and components used to manufacture these items. As with the leading indicator approach, this type of forecasting also involves cause-effect methods, but is harder to do because projecting a turning point in a business is predicated on forecasting a turning point in the economy.

3. Adoption models. These methods are useful for catching turning points in the sale of new products and technologies. In these cases, what drives a product's demand is the extent to which customers adopt or try the item for the first time added to replacement and repeat purchases. For durable items without repeat purchases, demand peaks occur at the point in time where the "majority" of customers start buying them, while sales decline as "laggard" customers buy them after most others have already done so. For consumable items with repeat purchases, demand peaks occur when the total of first time and (potentially multiple) repeat purchases start to decline following early growth in demand. This type of forecasting involves building quantitative models of first time and repeat purchases, often using life cycle curves.

4. Decomposition methods. These methods involve gaining a deep understanding of what drives a business in terms of underlying factors. For example, I caught the turning point that I mentioned above using this method. I was forecasting revenues that were comprised of recurring monthly billings and back bills. It turned out that revenue growth in one year was due to an exorbitant amount of back billings that year, and recurring monthly billings growth had been flat. I detected that back bills had distorted revenues, masking a real business slowdown that year. Had I not done so, I would have forecast growth the following year. Generally, these decomposition methods can uncover declining underlying factors that, over time, dominate the business, causing a turning point. Another example of this type of approach uses multi-tier forecasting methods that incorporate data from downstream supply chain customers. One can project a product's demand turning point, for example, by uncovering a surplus or shortage of inventories in its distribution channel.

Getting organizational buy-in

Detecting and forecasting a turning point is really only half of the forecasting battle. When you forecast a big change in business activities—especially a downturn—few will believe you. Sales and marketing personnel will deny it could happen, finance people will panic about margins and the CEO will have doubts.

I offer the following three pieces of advice to help you get buy-in to your turning-point forecasts—especially useful for downturn periods.

Stick to your guns. Clearly state that your forecasts are based on facts, figures and assumptions. The facts and figures can't be questioned, but subjective inputs (the assumptions) to the forecast will be questioned when a forecast goes against common thought. Therefore, be prepared to defend your position with hard facts and data, and reasonable subjective estimates that are hard to refute.

Force others to justify forecast changes. Many people in the organization will provide you with new program ideas for generating additional revenues to support a growth forecast, rather than a declining revenue forecast. Force them to prove that these will actually generate additional sales and revenue. Business-as-usual activities, such as annual promotions, are questionable. Why would they generate any more revenues than they did in prior years? Accept additional revenues into a forecast only from new innovative promotional ideas that have some merit.

Get executive support. While hard to do, getting executive support after forecasting a downturn is paramount. You'll need all the help you can get in sticking to your guns. You will be a *persona non grata* for a while, so you'll need friends—especially in high places. Getting executive support for a downturn forecast will require you to explain it in a clear, unemotional and unbiased fashion.

I think it's important to live through at least one downturn to test your mettle as a forecaster. You only have to successfully forecast one in advance to establish long-term credibility within your company. But, forecasting a downturn and sticking with that forecast is hard—much harder than joining the majority. Remember the words of Mark Twain: "Always do what is right: This will gratify some people and astonish the rest." Sage advice for today as a pandemic wreaks havoc and businesses are under tremendous stress from an economic rollercoaster.

***

* *L. Lapide, "Forecasting Heroes Catch Turning Points,"* Journal of Business Forecasting, *Summer 2001*

What does the human face of AI look like?

By Maria Jesus Saenz, Elena Revilla and Cristina Simon

When developing supply chain applications utilizing artificial intelligence (AI), it's vitally important to keep in mind that the working relationship between machine and humans is critical to the success of these projects.

Our extensive research shows that all too often projects are implemented without a clear understanding of how AI and people will work together as a team. A common pitfall is to underestimate the importance of pairing the predictive capabilities of algorithms with human expertise and intuition.

Maria Jesus Saenz is director of MIT Digital Supply Chain Transformation Research and a research scientist at the MIT Center for Transportation & Logistics. Elena Revilla is professor of Operations and Technology Management at IE Business School, Madrid, Spain, and Cristina Simon is the Inditex Professor of People Management. They can be reached at mjsaenz@mit.edu, elena.revilla@ie.edu and cristina.simon@ie.edu.

As part of our research to examine how companies use digital capabilities, we have developed a framework for these working relationships. The framework is based on four configurations of machine/human relationships for different AI project types.

Map your decision-making

Before applying the framework, it is advisable to assess the decision-making context of the application along two dimensions: the openness of the decision-making process and the level of risk. This will help managers to decide which teaming options are the most appropriate.

Decision-making openness can vary from closed to open, and each extreme requires a different approach to AI.

Closed decision-making has predefined rules for framing decisions. Think of an automatic language translator that is programmed to follow preset rules of grammar and meaning. Conversely, in an open process the rules are not well-defined because decision-making has to be open to unpredictable changes. Think of an AI-driven assessment of the supplier base for a large contract negotiation where a company is making key sourcing decisions in preparation for the talks. The behavior of the participants is difficult to foresee and the final contract terms are unknown, so there has to be some flexibility in what decisions can be made.

The level of risk assessment encompasses all relevant types of threats associated with the AI-based decisions such as reputational and financial risk. Knowing the risk level helps you decide whether making decisions based entirely on algorithms is acceptable or whether you will need the support of human expertise in the decision-making process.

Decision mechanics

In addition to assessing the decision-making environment that shapes an AI project implementation, it is also necessary to get a sense of the teaming capabilities you can harness. There are four types of capabilities.

Interoperability. How will humans and machines exchange information when required to meet the goals of the process? The AI system should specify the role of the parties in these interactions.

Authority balance. Will humans or machines have final control and when is this right exercised? Much depends on the level of risk. For instance, in high-risk situations immediate responses might be required.

Transparency. Transparent decision-making is key to building trust where humans and algorithms interact. For example, humans need to know what rules the algorithm follows while the algorithm should have clear instructions on when humans make final decisions.

Mutual learning. Just as machines learn from humans, humans can acquire knowledge from machines. How will these two-way loops operate?

Different combinations of these capabilities will be embedded in the design of projects, depending on the type of environment in which the AI/human team will perform. It is now appropriate to consider these various scenarios.

Four scenarios

Having established the type of decision-making regime you are dealing with, you can look at which teaming configuration best suits your project. We have identified four ways in which humans and machines can work together to make decisions. These scenarios are depicted in Figure 1.

Machine-based AI systems. In this scenario the circumstances are predictable and AI plays a central role in decision-making. Machines operate independently; humans play a supervisory role and intervene only when necessary. Interoperability is for audit purposes only, while transparency is not required.

An example is a warehouse system based on AI-powered autonomous mobile robots (AMRs). The variables that govern these systems (location, speed and type of product handled) and how they interact, are well-defined. Machines adhere to precise sets of rules and key performance indicators. The warehouse operator functions as a supervisory foreman and engages only to fine-tune or adjust the system.

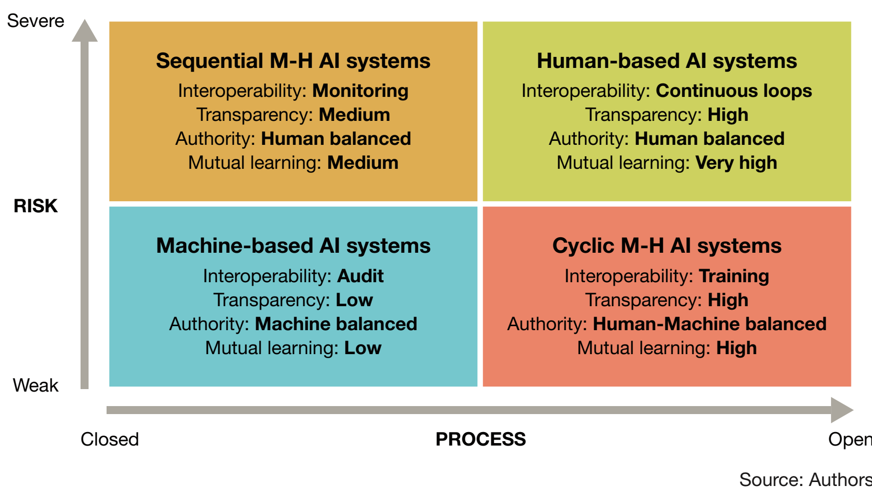
Sequential machine-human AI systems. Although machines operate independently in this scenario, humans need to do more than get involved only when needed—they must be ready to intercede to deal with unplanned contingencies.

The use of delivery drones is a case in point. In the future, AI-based systems that operate drones in densely populated areas will have some degree of autonomy, but human operators will probably be on standby for safety reasons. Even a hint of danger might require the support of a human. A level of transparency is needed in this scenario.

FIGURE 1

Human and machine teaming capabilities

Depending on the circumstances, humans and machines can work together in four different ways.



Source: Authors

Cyclic machine-human AI systems. Humans fulfill the role of coach in this scenario. In these low-risk, open settings, as long as the system is operating smoothly the human agent monitors outcomes without intervening in the activity. The human agent uses this knowledge to train the AI system. Given these interactions, a high degree of transparency is needed.

An example is the launch of a new product. Algorithms can be used to identify certain similar old products with enough historical data. The AI system is taught how to make better demand predictions for the new product.

Human-based AI systems. Open, high-risk decision processes where humans wield the final authority qualify for this configuration. In these scenarios, algorithms can make educated guesses but the high level of risk involved requires humans to have the final say. It is critical that the decision-making rationales are transparent.

Managing supply chain processes during extreme disruptions such as the COVID-19 pandemic is an example of this type of configuration. While AI-based systems can propose certain decisions, they are limited by the lack of historical data on these rare disruptions. Because the rules and behaviors are relatively unknown, it is difficult for the AI system to make predictions. The humans in charge make the decisions and interact with the AI system to assess future scenarios. This is an example of how algorithms and humans can collaborate.

Flexible approach

AI projects that achieve the right balance between machine and human involvement in decision-making are more likely to succeed. By using the framework we have developed to focus on this balance at an early stage in a project, teams can avoid a lot of wasted effort and sub-optimal results. However, the scenarios are not set in stone; project teams should apply them flexibly and be prepared to shift from one configuration to another as necessary.

A more detailed article based on this research was published in the MIT Sloan Management Review. It can be viewed at sloanreview.mit.edu/article/designing-ai-systems-with-human-machine-teams.

Rudolph, with his nose so bright, is moving from China

You need a roadmap to move supply from China.

By Matthew Lekstutis and Sandeep Shah

Matthew Lekstutis is the global managing partner, Supply Chain Consulting Practice, and Sandeep Shah is global managing partner, Procurement & Manufacturing Competency at Tata Consultancy Services (TCS). They can be reached at matthew.lekstutis@tcs.com and s.shah1@tcs.com.

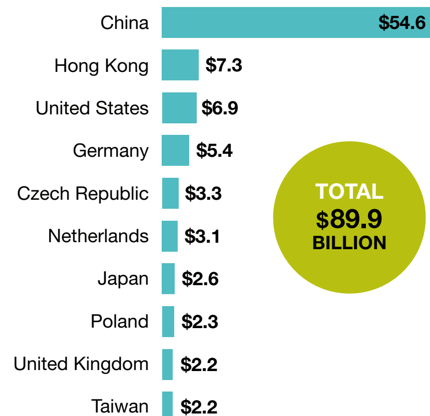
China is the world's largest manufacturer, logging a massive $2.5 trillion in output produced by more than 130 million factory workers, according to data from the United Nations Conference on Trade and Development. Not only is it the largest, but China has also long been the world's low cost, large-scale manufacturer of choice for a large swath of industries from consumer products, apparel, footwear, toys and many more. This is due in large part to a pool of very, very low-cost labor. Combined with a strong infrastructure in roads, modern factories and limited regulation, China's production meets insatiable demand from the United States and other countries for cheap goods.

For example, Santa's sleigh has been filled with toys from China and Hong Kong for years, representing nearly 70% of the world's toy production (See Figure 1). Putting that into perspective, those two locales represent almost twice as much production capacity as the rest of the world's toy manufacturing companies combined.

FIGURE 1

Top 10 toy manufacturing countries in the world

(shipping numbers listed in USD, billion)



Source: China's manufacturing capacity vs. U.S. tariffs, Richard Gottlieb, GlobalToyNews.com, August 2019

As the elves will attest, the toy industry is labor intensive: Imagine a Build-A-Bear party scaled up several thousand times. Built up over nearly 50 years, the Chinese toy industry is marked by very large factories, some employing more than 50,000 workers, and an ecosystem of feeder suppliers, many within 50 miles of the main factory.

While Chinese labor costs have been rising steadily at a rate of 10% to 15% year-on-year, leading toy customers have been slow to move into other countries simply because it's hard to replicate China's enormous manufacturing

capacity, its massive reliable infrastructure and high productivity. When it comes to product quality and safety, China offers higher performance than other low-cost countries, according to QIMA. Simply put, there isn't a readily available alternative supply chain outside of China.

That said, the supply of toys from China has been disrupted, first by trade tariffs and now by COVID-19, resulting in a search for new supply from countries like India and Vietnam. However, that is easier said than done for several reasons.

• ***How do you make a product from scratch?*** Much of what makes the process work is a combination of tribal knowledge and trusted partnerships that aren't readily documented. While procurement organizations may make a show of seeking out new manufacturing partners, they always end up using the same suppliers because of that combination. That is especially the case because more than 70% of toys are new each year and must be brought to market in time for the holiday season. You can assume that the risk of onboarding new suppliers for the holiday season is not high on procurement goal sheets.

• ***How do you scale up?*** Most of the current suppliers in the alternative countries are small and would need capital investments to scale up. Moreover, the lead time is often long based on licensing agreements and ramp up to uncertain market demand.

• ***How do you redesign a product so it is producible in a less mature supply base?*** Complexity is often invisible because Chinese factories have developed the capability and capacity over time to manage it.

For the above reasons, many companies are solely

FIGURE 2

Strategic sourcing approach

Source change stages and challenges

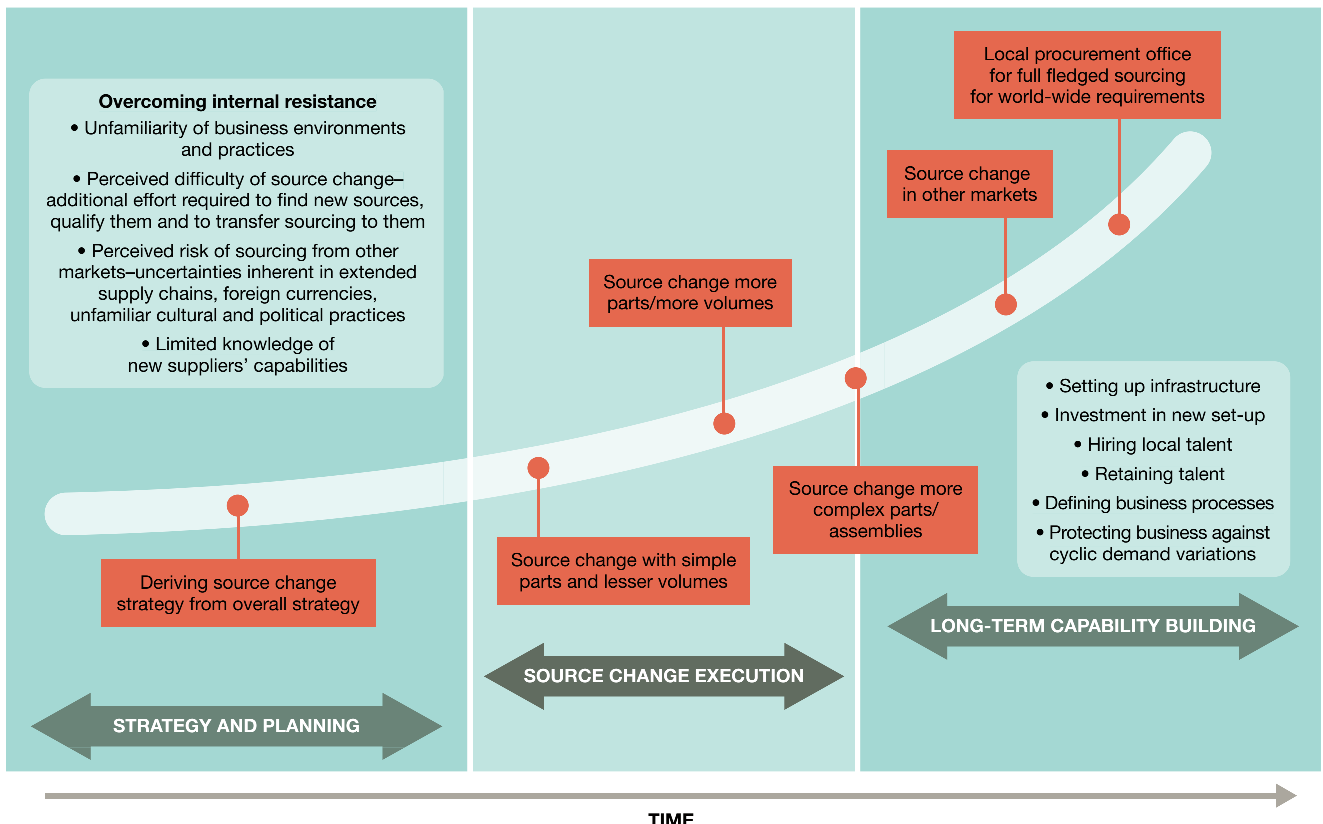


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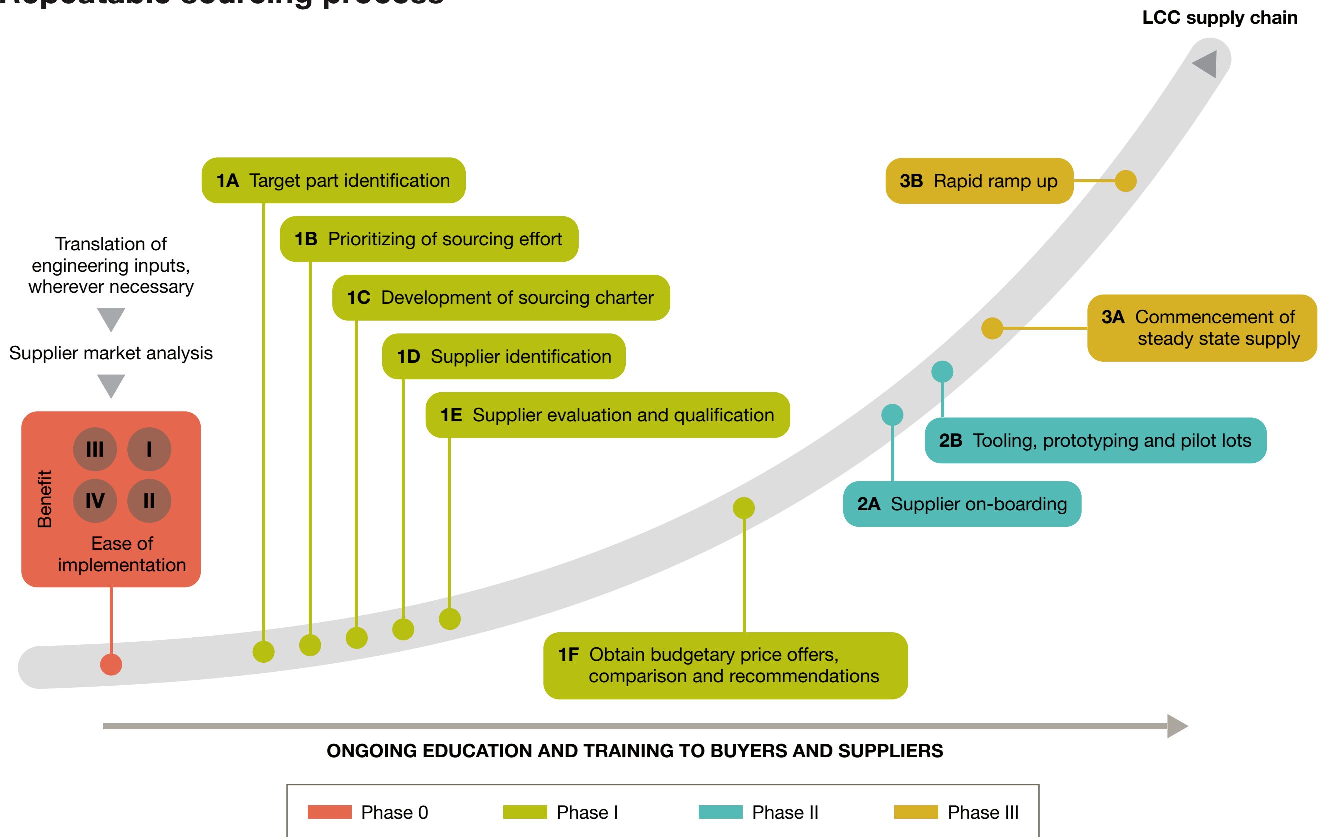
FIGURE 3

Repeatable sourcing process



Source: Authors

reliant on China's vendors and traditionally have only made very minor changes to their supply bases to mitigate some of the risk. And, as a result of this sole sourcing, they don't have the necessary resources, processes or expertise to scale the sourcing process to find, test and develop the supply base in alternative countries. Equally important is the need to achieve supply chain operating criteria for stability, delivery reliability and agility.

To address this conundrum, we developed a sourcing roadmap and process to help a leading toy company find, build and scale up supply so that it could move some production out of China and into India. The toy company has a range of product categories, including soft toys, plastic toys and interactive toys with smart electronics to name a few. The objective was to scale up the current supply base in India by over 400% (in dollar value) and still meet the high product safety, environmental and ethical standards the company requires. Working over a period of several months, the company developed a highly structured and repeatable process to identify, qualify and pilot production with a number of vendors and later move operations from China and ramp up in India to meet the sourcing goals. In the process, the company defined "should cost" and helped redesign some of the parts to make it producible at its suppliers in India.

The supplier diversification roadmap had the following key elements:

- defining criteria to identify toys suitable for production in India;
- a strategic sourcing roadmap;
- a repeatable and structured sourcing process from vendor identification to pilot production and ramp;
- a process to identify specific products suitable for production in India;
- fast tracked the identification of an initial set of vendors for evaluation based on a proprietary data base of vendors and their capability; and
- "should cost" modeling and redesign for market implications.

Figure 2 highlights the overall sourcing roadmap for moving the supply base. As you develop your own sourcing journey to move from China, it is critical to identify and start with simpler products and smaller volumes as the supply base in India and other countries is not as mature as that of China in terms of scale and supply reliability. India's toy manufacturing output is less than 15% of China's and not as mature.

Figure 3 highlights the phased approach from product assessment to production ramp up. Using this approach, along with a proprietary database listing viable vendors, the process identified a list of 58 potential suppliers and narrowed that to a shortlist of 16 for tooling trials. Based on the results of the tooling trials, the company finalized a select set and is now in the process of ramping up production for two different categories of products to meet current supply goals. The process from identification to making tooled samples and selecting the final set for ramp up was completed in 12 weeks. The result is a huge improvement compared to the existing process which took up to a year to qualify a supplier and was a major hurdle to moving production from China.

Moving sourcing from China en masse can be difficult given the sheer scale, infrastructure and know-how existing in the current China supply base. Companies looking to source from alternative low-cost countries should carefully assess which product categories can be moved, with a focus on moving simpler products with smaller volumes, setting a realistic expectation of what is possible and how fast it can be scaled up.

Sourcing large volume products is a challenge as the assembly lines can be large and not readily buildable in other countries. An equally important execution consideration is to have a very clear process for transferring the products and operations from China, especially given the combination of tribal knowledge and trusted partnerships we referenced earlier.

Finally, only sourcing some sub-assemblies may be an option, but it can be difficult without affecting the agility of the supply chain and higher costs from adding an additional step. It may require picking up and moving a step outside of China that can add at least two weeks in transit time to the overall supply chain, and increase the cost of shipping. Two weeks may seem insignificant, but for producing a product at 100,000 units a day, a two week longer supply chain is an additional 1.4 million units of lag in responsiveness to market demand or issues downstream. Longer supply chains have hidden costs that add up. What's more, companies will likely need to invest in their quality assurance and inspection programs. Rudolph's nose will have to shine bright to guide the journey to alternatives to China; however, the mitigation of today's growing risk may well be worth the effort.

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Using the PAST *as we work through the* PRESENT

Back in the summer of 2018, Bruce C. Arntzen, then the executive director of the supply chain management program at MIT, asked me if I was interested in publishing research he was doing with Nima Kazemi, a postdoctoral associate at MIT, into whether supply chains had learned lessons from the 2008 Financial Crisis and were ready for the next collapse of the economy. Underlying the research were two simple questions: What will trigger the next collapse? And, were supply chain managers listening to the warning bells Arntzen and Kazemi were hearing and preparing their companies to survive the next recession?

At the time, it seemed a little crazy to publish the two-part series they had put together. After all, the stock market seemed to have overcome the laws of gravity and continued to push ever higher. But, we went ahead anyway.

Fast forward to late winter. As we began to put together the issue you're reading, the answer to the first question seemed clear: A pandemic. And this time, it seemed foolish not to take a look at the second question. More than ever, supply chain managers need to look to lessons from the immediate past for insight into how to mange their supply chains in today's crisis.

There is no doubt that playbooks will be re-written and risk management and resiliency will be front and center. Heck, at *Supply Chain Management Review*, my executive managing editor, Sarah Petrie, my art director, Polly Chevalier and I tore up our plans for the current issue to focus instead on crisis management.

For that reason, this issue includes a new article from Brent Moritz, a supply chain management professor at Penn State. But we're also reprinting the two articles from Arntzen and Kazemi; a 2013 article about the 2008 financial collapse and recovery from Kai Hoberg and Knut Alicke; and an update of an article following the 2008 financial collapse by Jonathan Hughes from Vantage Partners.

As I was finalizing the lineup, I reached out to some of the authors, starting with Bruce Arntzen, who is now retired. "We all knew it couldn't last forever, the 2010-2020 bull market," he wrote in an e-mail. "Our guess was that the end would come from Crimea, Brexit, Sequestration, the 2016 election, the trade war, or fallout from Greece, Isis or Syria. Instead, it's a pandemic. Re-reading these articles now, I think they'll help supply chain managers understand what's happening around them, how to respond and how to better prepare to survive in the next recession." While we won't be including it in this issue, we're also reprinting an earlier article by Arntzen following the Financial Crisis. You can find it on scmr.com.

Kai Hoberg, a professor and head of the logistics department at Kühne Logistics University, noted the current COVID-19 shutdowns have the potential to trigger an even bigger decline in the global economy than the 2008 Financial Crisis. For that reason, "the five action areas we identified from our study of the Financial Crisis are today more critical than ever." But while getting through the crisis is important, he advises that the more critical issue is preparing your supply chain "for the upswing that might come suddenly after quarantines are lifted."

I hope you find this lineup of articles meaningful as you work to get through this crisis and bring your supply chains back online. In this difficult time, our thoughts and prayers are not only with your supply chains, but also with your families and loved ones.

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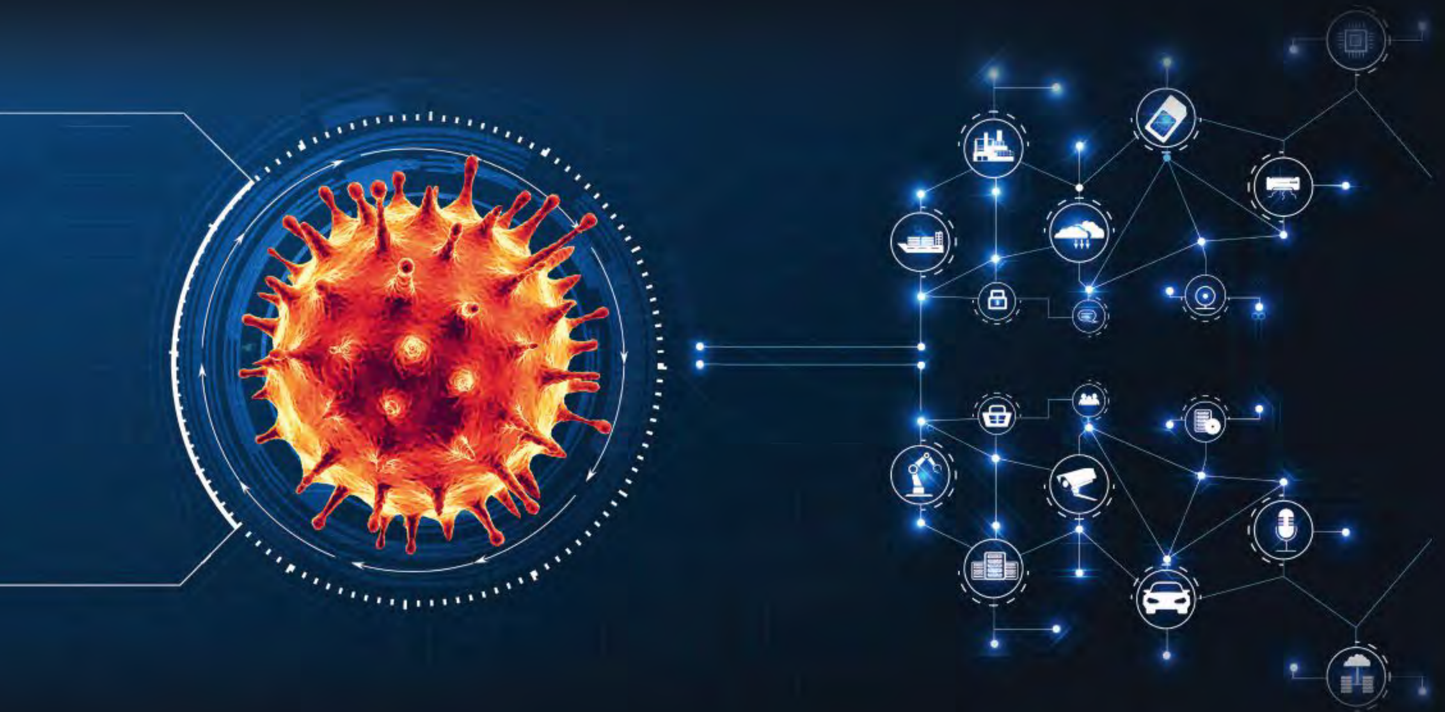
Supply chain disruptions and COVID-19



What is different about COVID-19 and other supply chain disruptions?

BY BRENT MORITZ

This morning, I taught my first full class in front of a computer instead of in front of my students. Like nearly all universities, Penn State has canceled in-person classes and is moving to remote/online instruction. My class is for seniors majoring in supply chain management, and it is (and will be) somewhat awkward to teach a case-based discussion course online.

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Per the syllabus, the already scheduled topic of supply chain risk management is taking on a whole new urgency for many firms, industries and society as a whole with the spread of COVID-19. It seemed like a good time to share some of what we are and will be talking about in class with our supply chain partners.

A caveat: My research expertise is in supply chain decision-making; with Christopher Craighead, now at the University of Tennessee and an *SCMR* contributor, I co-wrote a popular case about how firms can deal with a supply chain disruption. Yet, that focused on the bankruptcy of a supplier and the impact on a tier-1 firm. Today the news is about Disruption with a capital "D." So, what are some of the differences between COVID-19 and other disruptions? There could be more, but I discuss seven dimensions here, which are summarized in Table 1.

Geography. In most cases, a supply chain disruption is limited to a region or country. For example, we are used to hurricanes hitting Florida, or earthquakes in California. This past year, we saw massive wildfires in Australia. No one should discount the suffering after natural disasters like Hurricane Katrina on New Orleans and other areas. Yet one difference with a pandemic like COVID-19 is that it is hitting the entire world. This is important because under normal circumstances, resources from one region can support affected regions. For example, utilities send repair crews in from out of state, and even firefighters and equipment from the United States recently assisted in Australia. This is very difficult to do when everyone is simultaneously affected.

Scope. Beyond geography, COVID-19 has nearly unprecedented scope. In an ordinary disruption, we might see a few key industries knocked offline for weeks or months: Hurricane Harvey took much of the U.S. Gulf Coast petrochemical industry offline for several weeks, yet West Coast refineries were not affected. Unique about COVID-19 is that it is affecting both goods and services. Clearly there is increased demand for masks and hand sanitizer, so it is logical that those items would be in short supply. However, there is fundamentally no increase in demand for toilet paper, so shortages there are unusual and related to human behavior. But, the impact of COVID-19 is that demand for services is greatly diminished. We cannot stockpile an inventory of services or experience goods, so those are, at best, delayed. This includes things like the cancellation of all sporting events, idled cruise ships, empty hotel rooms and the widespread cancellation of airline flights. In addition, most shops and restaurants are closed. The week before I wrote this article and before the official shutdown, I went into my local barber shop (as yet we had no COVID-19 cases reported in my county or nearby). There were six employees standing outside; I was the only customer in the shop the whole time. Here in State College, much of the economy revolves around university students, all of whom are now staying home. All of this will have knock-on effects throughout the entire economy.

Demand vs. supply. Many supply chain disruptions affect supply. I have already mentioned several, and today in class the previously assigned reading was about a well-known fire in a Philips Electronics chip plant in 2001 and the impact on major mobile phone makers Nokia and Ericsson. At the time, Nokia had 27% of the global cell phone market and Ericsson had 12%. Lightning struck the Philips plant, causing a loss of chips, yet the real damage was that the plant was contaminated and could no longer produce chips for these and other firms. However, how Nokia responded was unique—with fast communication, an all-hands-on-deck approach and coordination that saw them weather the storm with minimal disruption. Ericsson took a much slower approach and was far more vulnerable to this supply disruption. In the end, Nokia gained 3% of the global cell phone market (mostly from Ericsson), and subsequently Ericsson ended up exiting the handset business. There have been some supply disruptions due to COVID-19 and there will be more disruptions in manufacturing, distribution and transportation in the upcoming weeks.

However, COVID-19 is (and will be) affecting demand. Perhaps you have seen news reports about major airlines canceling all international flights, and 40% of their domestic capacity. Beyond this, demand will be affected even when there is virtually no disruption in supply. For example, look to the Fukushima Daiichi nuclear disaster following the earthquake and tsunami in Japan in 2011. Shortly after the disaster, luxury goods maker LVMH closed 50 stores in Japan. The supply chain for high-end merchandise was relatively unaffected, yet few people wanted to be seen with a new Louis Vuitton handbag when tens of thousands of their neighbors were suffering. Other luxury brands were similarly affected.

In the case of COVID-19, the size and duration of the impact is not clear. For example, one can easily imagine that the demand for new cars will decrease, both because some individuals may lose their jobs or see hours cut and understandably reduce their spending. Yet demand will also decrease because the perception of conspicuous consumption of new goods is likely to mute demand in the face of a global disaster.

Prior planning and experience. For many disruptions, planning and prior experience are guides. For example, factories in the Midwest and elsewhere have tornado-safe locations for their employees. Elementary schools regularly practice fire and tornado drills. Refineries in the Gulf Coast plan for hurricanes, and hospitals have emergency generators. Yet there is limited prior planning for a global pandemic such as COVID-19. Yes, the United States is supposed to maintain a strategic stockpile of ventilators and other supplies, yet, as we are learning, no amount of inventory would be sufficient under the worst-case scenarios. Perhaps more important than inventory and planning is the lack of experience: Experts refer back to the 1918 Spanish Flu outbreak for guidance, yet no public health experts have personal experience with this type of global pandemic. (The historical contrast between Philadelphia and St. Louis is telling, as the former went ahead with a large, public parade with after which thousands of additional individuals became infected with influenza; St. Louis experienced far fewer cases and deaths after implementing quarantine procedures.) Of course, it's a good thing that we do not regularly have pandemic events, yet that makes these unprecedented times for firms, world leaders and individuals who are learning in real-time the best steps to take.

Financial system. Most often, when there is major disruption, the financial impact is relatively contained. Events such as Pearl Harbor and 9/11 saw a comparably small impact to the stock market. The closest thing might be the global Financial Crisis in 2007-2008. Yet, that crisis had a comparatively limited supply chain impact. If anything, there was more supply and less demand, yet there were no major, sustained disruptions to production or transportation networks. In contrast, we have seen global stock markets crash and central banks and governments undertake unprecedented actions to support the economy. The reason for this is that the COVID-19 demand shock is leading to a financial disruption. If this goes on, we will continue to see small businesses cut employees or close and many firms will have difficulty raising capital or repaying loans—preserving cash will be crucial.

Term. For most disruptions, the term is limited—or is at least quantifiable. For example, most disasters see short-term demand for rescues or emergency services immediately after an event. However, the term for COVID-19 is relatively unknown. We have seen a significant spike in

TABLE 1

Dimensions of supply chain disruptions for COVID-19

DIMENSION	TYPICAL DISRUPTIONS	COVID-19
Geography	Most disruptions are local or regional.	COVID-19 is widespread and global, affecting all regions.
Scope	Limited scope: Fewer industries affected (i.e., a hurricane disrupts the petrochemical industry).	Widespread scope affecting both goods (like toilet paper) and services (haircuts, restaurant meals). Closure of sporting events, cruise ships, schools/universities, etc.
Demand vs. supply	Disruptions most often affect supply, sometimes demand.	Affects demand, and possibly supply.
Prior planning and experience	Disaster planning has been done, and prior experience is available.	Limited disaster planning for global pandemic, with limited prior experience (1918 Spanish Flu).
Financial system	Low to moderate correlation with global financial system.	High correlation with global financial system.
Term	Short-term needs for emergency services (i.e., flood rescues).	Longer-term emergency service needs (i.e., hospital beds, ventilators).
Human impact and behavior	Localized human impact, with limited duration. Public fear is short-term, and most risks are visible (i.e., experiencing a tornado or earthquake).	Widespread human impact, with unknown duration and unknown impact. Public fear is longer-term and risks are invisible/unknown.

Source: Author

the demand for hospital beds and ventilators, and social distancing is working in some areas to keep the number of infections below the system capacity. While most large disruptions have a defined short- or medium-term that can be fairly accurately predicted, the term for a global pandemic is long and uncertain.

Human impact and behavior. For the majority of disruptions, the human impact is relatively limited. Naturally, there are immediate and consequential injuries following a natural disaster. Yet, these are limited by location and are somewhat understandable: Natural disasters can be terrifying, but fear largely subsides when they are over. In contrast, COVID-19 has many unknowns. Most of us are not infected, but it is still very natural to be concerned for family members, friends, co-workers and heroic first-responders. We do not know how long this will last, nor what the consequences will be. I doubt that many of us would prefer to live through a major tornado over practicing social distancing, yet we should not discount the impact on behavior. That is perhaps one reason for increased demand for toilet paper: People feel the need to do something to prepare, even if the underlying consumption of toilet paper remains constant.

Other impacts. There can more COVID-19 effects. For example, many pharmaceuticals and machine parts are made in Switzerland, and these are regularly shipped worldwide in the cargo space of commercial airliners. If the global air network is disrupted over the long-term, this could lead to shortages or other impacts. In addition, firms and governments are likely to reconsider their supply chains to reduce systemic risk. There will be considerable work to re-design supply chains to improve resiliency. Much of the global pharmaceutical industry relies on materials made in China, and many industries (like automotive) have complex supply chains. All of these relationships will need to be re-examined.

What to do

Supply chain leaders should prepare for additional disruptions in supply and transportation. Yet if you are a business chain leader, what are some things you could do right now? There are some strong resources on supply chain risk management , but most resources focus on developing a resilient supply chain and have less to do with facing an immediate crisis. As I told my students this morning, these are unprecedented times, yet we will get through these by working together and with flexibility. This is unlikely to be the last supply chain disruption, though it is likely to be one of the most memorable. Each of us should listen to public health authorities and do what we can keeping in mind the unique circumstances.

Beyond that, consider three additional steps: First and foremost, ***take care of your people***, including employees and customers. Employees will likely need to be reassured about what is happening at your firm, so maintain effective communication. If anything, over-communicate, especially if there are significant changes to regular operations. Provide opportunities for employees to talk with you or their manager. Support your customer-facing employees and logistics personnel who must keep working when others are in quarantine. Second, ***be flexible***, and encourage flexibility. There will be inevitable disruptions as schools remain closed, and more individuals contract or care for those with COVID-19. Letting people know they should remain home if they feel ill or are in contact with someone who has the virus is key. Third, this is a good time to ***review and update emergency plans and contact information***. Make sure several layers of backup employees are available for key activities, and update emergency contact lists so that these backup employees can communicate with others. Finally, months or years from now, employees and customers are unlikely to remember what you said, but they are likely to remember how they felt. Act accordingly.

[I] *Latour. 2001. Trial by Fire: A Blaze in Albuquerque Sets Off Major Crisis for Cell-Phone Giants. The* Wall Street Journal*; New York, N.Y.; Jan. 29, 2001, p. A1*

[II] *Helper, Gray and Osborne. 2020. Retooling US Supply Chains to Address Weaknesses Exposed by new Coronavirus. Washington Center for Equitable Growth. equitablegrowth.org/retool-u-s-supply-chains-to-address-weaknesses-exposed-by-new-coronavirus/ retrieved March 16, 2020*

[III] *Some recommended additional resources include the following:*

Melnyk, Closs, Griffis, Zobel and Macdonald. 2014. Understanding supply chain resilience. Supply Chain Management Review. *Jan/Feb 2014*

Chopra and Sodhi. 2004. Managing Risk to Avoid Supply Chain Breakdown. MIT Sloan Management Review*, Fall 2004, pp. 53-61*

Sheffi, Y. 2005. The resilient enterprise: overcoming vulnerability for competitive advantage. MIT Press Books

Is your supply chain ready for the next recession?

Remember the Great Recession? More than 10 years later, are supply chains better prepared now than in 2007?

BY BRUCE C. ARNTZEN

Editor's note: This is the first of a two-part series on recessions and supply chains.

The crash of 2008 is just a memory. The layoffs, bankruptcies, foreclosures and bailouts of 2008 through 2013 have faded away. Good times are rolling again. Employment is near a record high, businesses are expanding and the stock market is at record highs. What's not to like? Given all of the economic exuberance, we might sound a little like a voice crying in the wilderness, but someone needs to ask the question: How long will it last?

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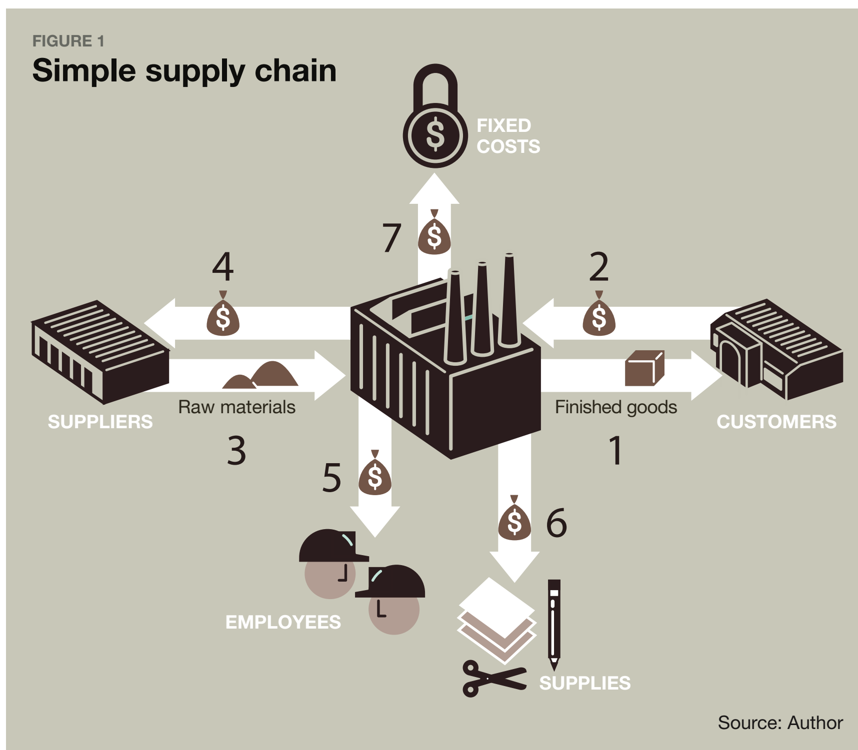
Consider this: A senior manager in his or her 60s has seen stock market crashes in 1962, 1974, 1981, 1987, 2002, and 2008. Before the crash of 2008, the average drop in the stock market for these crashes was 29% (range of 22% to 35%) and the average time to recover their value was 18 months (range 14 months to 23 months). Stock markets signal the beginning of a recession but not the end. The employment rate begins falling and keeps falling for a year or more after the markets are already recovering nicely. The employment rate is a better signal for the end of a downturn and it usually takes twice as long as the stock market to recover.

The crash of 2008 and the recession that followed were much worse than normal for this era. The Dow Jones Industrial Average fell 53% from 14,093 to 6,600 and did not regain its former value for 5 1/3 years. The unemployment rate rose from 4.4% to a peak of 10% one year after the market crash. It took employment another nine years to return to pre-crash levels. During the recession 7.9 million people in the United States lost their jobs, 6 million homes went into foreclosure and 4 million businesses closed.



We have now enjoyed 10 years of recovery from this latest crash and recession. The U.S. stock market has shot past its pre-crash level of 14,093 and soared to a range of 25,000 to 27,000. The unemployment rate has shrunk to below 4% as of the most recent jobs report. But the statistic hangs over us: 9 years between crashes is the recent average. Maybe it's time to see how prepared we are for the next crash. Did we learn anything? Are supply chains better prepared now than in 2007?

Bad decisions made in good times

Good times are dangerous: Business managers are under constant pressure to bend the rules, be flexible and agree to policies during good times that will cause great pain and suffering when the economy goes south. Consider Figure 1 that illustrates a simple supply chain. As long as customers keep buying and paying for product this model works nicely. But the moment the stock market crashes customers will stop buying and stop paying. Why? In a recession, "cash is king." Unless you have a huge financial war chest, the goal is to make it to the other side of the recession before you run out of cash. Let's look at each flow in the diagram and see how companies get into trouble and what they should do during good times to prevent it.

Flow 1: Customer orders. This is the first flow to be affected. Customers will seek to cancel orders, push out orders and trade down (buy less, buy less expensive). Listen to this exchange:

Before the crash. Salesman: "In this industry, we do business with a handshake. My customers are honorable people and we trust each other to honor our commitments."

After the crash. Corporate attorney: "Our customers dropped us like a rock. They cancelled all their orders and we have no contracts and no risk sharing agreements. We built product based on their forecast and now

they will not take delivery. We're screwed."

Allowing the sales force to be lackadaisical in good times is bad management. What should you be doing now? Two simple things are: 1) risk-aware contracts with customers including time fences for transfer of ownership for long lead-time items, provisions for sharing information and risk and cancellation penalties in place. 2) CPFR with customers so that risks are shared among all players in the supply chain.

Flow 2: Customer payments. Losing this flow hurts the most. Customers want to hold onto their cash so they seek to delay all payments. But during good times your own sales team will seek to loosen the rules.

Before the crash. Sales manager: "It was great! By allowing our customers just a few more days to pay we increased sales 5%."

After the crash. CFO: "We allowed the salesmen to give away terms to close more deals. They gave terms of 60, 90 and even 120 days to pay. Now the lack of cash is killing us."

Salespersons on commission naturally put their own pocketbook ahead of the company's best interests. If management fails to police the sales team during good times this is a likely result.

Before the crash. Salesman: "We're on the verge of landing a big deal with this customer. If you badger them about a few late payments it will sour the relationship and kill the deal. Don't you want us to make money?"

After the crash. Chairperson: "We backed away from rigorous invoice collections because sales was worried it would kill some big deals. Now customers just blow us off when we try to collect. Every day that we cannot collect means a few more employees will be let go."

Customers often test the terms of payment to see how far you will let them go. During good times you have to be diligent about collections because any acquiescence to late payments will be exploited during a recession.

Flow 3: Incoming raw materials. If customers won't take delivery of your products why don't you just refuse delivery of inbound raw materials that you no longer need? Consider this exchange:

Before the crash. Hardware engineer: "We take great pride in our product designs. We use cutting edge materials and components to get industry leading performance out of our products."

After the crash. Purchasing manager: "We let the engineers design in all kinds of fancy new unique materials. Now we cannot cancel orders of those materials. We are bleeding cash for stuff we don't need."

If you order industry standard parts you can sometimes cancel those orders because the supplier can sell them to another company. But if you order unique custom-made parts you are legally obligated to take delivery and pay for it. Such parts are NCNR (non-cancellable non-returnable) and present a big financial risk to your company.

Just like you, your suppliers want to keep the pipeline moving. This means having you take delivery of goods and remit payments on time. But as we have seen from above, cash is likely to get very tight in your company.

Flow 4: Payments to suppliers. Just like you, your suppliers want to keep the pipeline moving. This means having you take delivery of goods and remit payments on time. But as we have seen from above, cash is likely to get very tight in your company. You can surely turn to a bank for a line of credit. Right? Think again.

Before the crash. Banker: "Your company is a pillar of our community and we are proud to serve your financial needs. Investment advice, payment processing, trade finance, lines of credit—whatever you need."

After the crash. CFO: "Now that we actually need credit the bank won't even answer the phone. They treat us like 'damaged goods.'"

It is a great idea to secure lines of credit while business is booming. Banks tighten credit at the first sign of trouble. A related risk is that a key supplier will go bankrupt during the recession:

Before the crash. Purchasing agent: "My supplier is not a risk. Even though they are a private company, they have been around for 20 years and the owners live in my same neighborhood. Their kids play with my kids."

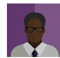
After the crash. CFO: "Purchasing never even asked about their financial situation. When they closed we

lost our only supplier. It will take us 90 days to bring on a new supplier—if we can stay afloat that long."

What should you be doing now? Monitor supplier's financial health with quarterly business reviews. Have a second source of supply especially for critical parts and keep extra inventory days on hand for hard to replace parts.

Flow 5: Labor costs. Great employees are your most valuable asset. It takes money and effort to hire them, train them and maintain enthusiasm. The last thing you want to do is lay them off. Because of this many companies downsize too slowly losing money the whole time. Consider this exchange:

Before the crash. HR manager: "I'm proud that we were named the No.1 company to work for. Our 10,000 full time employees enjoy great health, dental and vacation benefits. We also match 8% of 401 (k) contributions."



After the crash. CFO: "Because all our workers are full-time employees it is taking forever to shrink our cost structure. The inability to scale back some jobs may end up costing everyone's job."

Great employees are your most valuable asset. It takes money and effort to hire them, train them and maintain enthusiasm. The last thing you want to do is lay them off. Because of this many companies downsize too slowly losing money the whole time.

What cost structure would be better in a recession? A variable cost structure such as using a contract manufacturer who is paid based on volume. Similarly a 3PL instead of your own WH and your own employees allows you to scale up and down based on your needs. Also a workforce with flexible hours who are cross-trained in several functions can help you ramp up and down.

Flow 6: Indirect spending. Computers, paper, desks, printers, copiers, coffee, newspapers, bottled water, lunches, projectors. Every company spends a large amount of money on indirect materials and supplies. Who buys these things in your company? Consider this exchange:

Before the crash. Administrative assistant: "It's really convenient. Tom, the delivery man, brings the supplies right to my desk. Really nice guy. I just go to the website and order any supplies we need on my corporate credit card."

After the crash. Head of purchasing: "Every secretary in the company was a purchasing agent with their favorite suppliers. After the crash it took a full year to rein them in and get control of spending. We could have saved many jobs if we had acted faster."

Spreading out purchasing across many people is dangerous unless you can turn off the spigot in a hurry. Everyone has the attitude that "it won't bankrupt the whole company if I just buy these pencils." Lax controls in good times means slow reactions later.

Flow 7: Fixed costs. Fixed costs include things like rent, insurance, utilities, property taxes, interest on loans and monthly payments on equipment. These are very hard to reduce quickly. Yet during good times managers love to expand.

Before the crash. Country manager, France: "We took advantage of the upturn in the economy to build our own dedicated distribution center right here in France. And we have our own dedicated fleet of delivery trucks. We now control our own destiny."

After the crash. CFO: "Country managers built their own little kingdoms. We now have redundant facilities all over Europe and the fixed costs are crucifying us. Cash is flowing out, none is coming in."

In this case, the same local presence could be achieved by contracted services with a variable cost structure.

The lesson

Many of the "before the crash" arguments outlined here sound reasonable and make plenty of sense if you have just enjoyed 10 years of solid economic growth. It is hard to say no to these, especially when your peers in sales, purchasing, facility management and engineering are all pressing you to say yes. It is only after you hear the "after the crash" statements that you realize these are unsound arguments.

Did we learn anything from 2008?

Is your company ready for the next recession? And, how can you tell? If you are on the inside of a company, in theory, you can look at all the areas listed above to see how many good and bad practices you have. Likely, no one person in the company has this visibility currently. With a determined and enlightened management team this could be done. Besides supply chain, it requires

the cooperation of all the groups listed: sales, finance, purchasing, engineering and legal. But some of these groups, specifically sales (re: payment terms) and engineering (re: industry standard parts), are more likely to defend their own actions than help prepare for the next recession. The biggest barrier however is complacency—from the drug of good times.

But what if you are on the outside? How can you tell if a firm is recession-ready? For privately held companies you have very little information to go on. For publicly traded companies you at least have their annual reports and financial statements. Financial analysts use a variety of indicators from these reports to judge the health of a company. They include price to earnings ratio, dividend yield, return on equity, debt to equity ratio and dozens more. But which indicators shed light on the supply chain practices that we listed above? As an outsider we cannot measure exactly what we want to. But we have selected and also invented a few indicators that are directionally correct. If taken together they can be good predictors of a company's recession readiness. They are as follows:

- revenues (in 2007 bill $);
- profitability (net income/revenue);
- how leveraged? (total liability/total assets);
- liquid working capital (working capital-inventory) (in 2007 bill $);
- variable cost structure (COGS/PP&E);
- revenue per employee (in 2007 $K); and
- accounts receivable (expressed as days sales outstanding).

Some of the business practices described above are captured by our metrics fairly well. For example, the ratio COGS/PP&E reveals a company's variable cost structure. As a company outsources more of its manufacturing to outside contractors on a variable cost basis, this ratio increases. Revenue per employee is a good indicator of workforce flexibility (if we measure only full-time employees). Increased outsourcing, more contract employees, fewer full-time employees, higher productivity or other factors will increase this indicator. The business practices of rigorous collections and strict payment terms are both nicely captured by accounts receivable expressed as day sales outstanding.

Unfortunately, for some supply chain practices we do not have good indicators from the publicly available information. These include purchasing controls, risk-aware contracts and the use of industry standard parts. However, we also include a few traditional metrics in our "recession readiness assessment" including revenues, profitability, leverage, and liquid working capital. Note that we subtract inventory from working capital because inventory is not liquid during a recession.

Many of the "before the crash" arguments outlined here sound reasonable and make plenty of sense if you have just enjoyed 10 years of solid economic growth.

100 manufacturing firms—coming soon!

We are performing research to examine the recession readiness of 100 small- to medium-sized manufacturing companies in the United States. Note that we have avoided large manufacturing companies because they often include unrelated lines of business such as insurance and leasing.

The results of this research will be reported in the January 2019 issue of *Supply Chain Management Review*. Our goal here is compare a significant number of companies to themselves over time. Specifically three points in time: 2007 (before the 2008 crash), 2009 (at the bottom of the 2008-2010 recession), and 2018 (before the next crash). Following are some of the questions that we are asking:

- What fraction of manufacturing companies did better or worse or had no change during the 2008-2010 recession? How much did performance go up or down?
- Can we see any pattern as to which companies did better or worse than others during the recession?
- Are these companies in better shape now (2018) than they were in 2007 just before the last crash?
- Is the "recession readiness" of a company correlated to how well it performed during the last recession? (If a company was hurt badly have they now steeled themselves against the next recession?)

Let the good times keep rolling for now, but we suspect they won't last forever. Financial markets reflect society's expectations and as the clock ticks past 10 years, many become nervous. Is there still time for companies to fix their dangerous "good time" practices? Do they even realize that they should?

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RECESSION READINESS 2020

Did we learn anything?

The laws of gravity still apply: What goes up will come down. Yet time and again, a strong business cycle and fading memories convince us the good times will go on forever. We surveyed 100 manufacturing firms to find out if businesses are ready to fight through the next recession.

BY NIMA KAZEMI AND BRUCE C. ARNTZEN

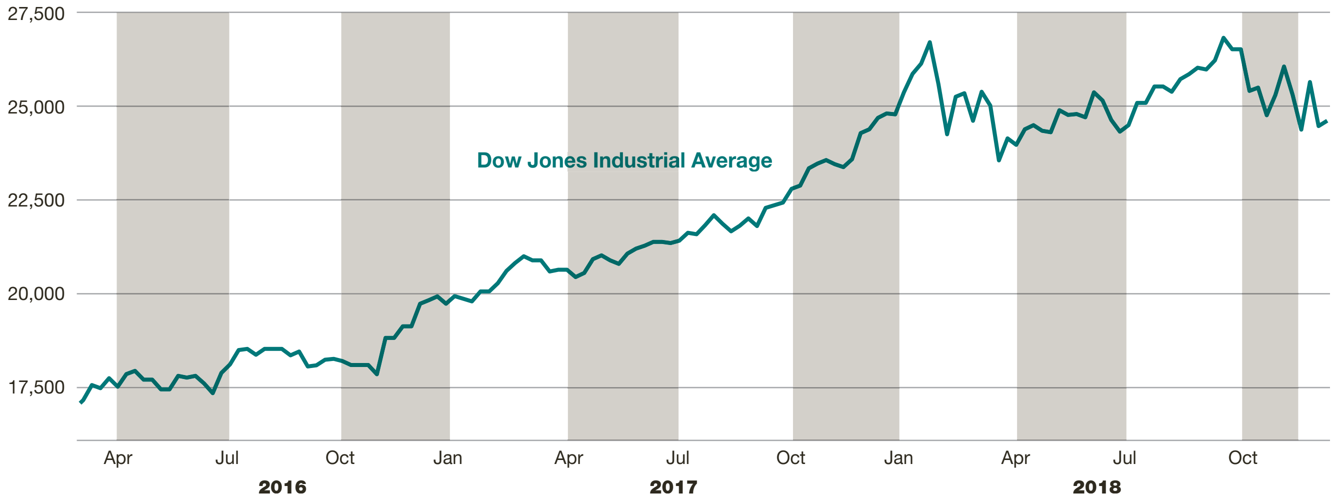
Editor's note: This is the second of a two-part series on recessions and supply chains.

Did we learn anything from the big recession? Is it really different this time? And, are manufacturing companies in better shape now to survive the next recession than they were in 2007? Recall that things were pretty bad between 2009 and 2013, when 4 million businesses closed in the United States, almost 8 million people lost their jobs and unemployment reached 10%. But now we've had 10 years of strong growth and recovery. Unemployment has fallen to 3.7%. The Dow Jones Industrial Average rose 306% during that time—almost reaching 27,000.

Both the United States and world economies are cyclical with a crash roughly every nine years. And, when the stock market gets very high investors get very nervous. As if to confirm their fears, the U.S. stock market has recently become notably volatile. Compare the volatility of the last 10 months to that of the prior 20 months in Figure 1.

FIGURE 1

The U.S. stock market has become more volatile in the last 10 months



Source: finance.yahoo.com

It's a given that the stock market will crash again, and that might happen fairly soon. So we sought to determine if companies are now in a better or worse position to fight through the next recession than they were in 2007, just before the last recession. Have fading memories and 10 years of good times allowed bad business practices to creep back in? Have they increased their debt? Has their workforce ballooned? Have they added more fixed costs so that their cost structure is less resilient? Have they relaxed their collections of accounts receivable? To find out, we surveyed 100 manufacturing firms.

What we studied

We focused on publicly traded U.S.-based small- to medium-sized manufacturing companies. We chose manufacturing because these companies have complete supply chains with all of the players and all of the flows. We explored publicly traded U.S.-based companies to facilitate data collection. And we studied small- to medium-sized companies (average revenues of $3.3B, range of $0.5B to $24B) so that the financial statements would not be distorted by other businesses such as insurance, finance or leasing. We chose to compare their financials for three years: 2007, 2009 and 2018. 2007 is the year right before the market crash, 2009 was the bottom of the recession and 2018 is the year right before the next market crash (perhaps).

We collected data for the 100 companies from the database Capital IQ Compustat. The data included balance sheets, income statements and other information such as the number of employees. Note that companies that were too weak to survive the 2009-2013 recession are obviously missing from our study. Thus, our findings are limited to those companies that were already strong enough to survive the last recession. For our analysis we used eight metrics outlined in Figure 2.

These metrics were selected or created to be indicators of good (or bad) supply chain business practices. All monetary values for years 2009 and 2018 were converted back to constant 2007 dollars to enable the comparisons. We carried out two different analyses on these metrics to get different insights into the recession readiness of companies. The details of the analysis are provided below.

Horizontal analysis

The first analysis was to look at one metric at a time across all companies. We call this "horizontal analysis." The method compared the average value of each metric in 2007, 2009 and 2018 to see if companies did better or worse in each year.

Revenues. Starting at $3.32B in 2007, average revenues dropped by 9.4% during the recession, but now have risen to 7.8% above pre-recession levels. Since revenues have recovered and companies have grown, they are overall in a stronger position in 2018.

Profitability. Starting at 6.8% in 2007, average profitability was cut in half during the recession, but has now

recovered to about 85% of pre-recession levels to 5.8%. Thus, companies are in a slightly weaker situation now than in 2007.

Leverage. During the recession, leverage grew from 43% to 46% as companies took on more debt. Nevertheless, they did not recover after the recession and leverage has continued to grow, now to 49%. In our survey, 14 companies reduced their leverage by 25% or more from 2007 to 2018 while 35 companies increased their leverage by the same amount. According to S&P Global Ratings, U.S. companies are sitting on $6.3 trillion of debt, the most they have ever recorded. Overall, this puts them in a weaker position than in 2007.

Working capital. Companies grew their working capital even during the recession and have further grown it during healthy times. But, working capital is a double-edged metric for a recession. It is usually good to have current assets, but as we noted in our first article, inventory is hard to move in a recession short of a fire sale (not liquid, ties up needed cash) and accounts receivable are much harder to collect. Therefore, the negatives offset the positives.

Variable cost structure. This metric got significantly worse during the recession and has continued to decline during the recovery. Fixed costs are now a bigger part of companies' cost structures. In our survey, 16 companies moved closer to a variable cost structure by at least 25% from 2007 to 2018 but 34 companies moved the same distance away. Companies should be moving toward a more variable cost structure for more resilience, but instead more are doing the opposite. This puts them in a weaker position than in 2007.

Revenue per employee. This metric dropped about 8.3% during the recession indicating that company revenues shrunk faster than companies could shed their employees. After the long recovery, the revenue per employee is still down 6.8% from the pre-recession levels. Verdict: They are in a weaker position compared to 2007.

Accounts receivable. This metric shows the opposite of what you would expect: as sales drop, existing accounts receivable should represent a higher and higher DSO (days sales outstanding). But, it actually improved (shrunk) during the recession likely due to strenuous efforts to collect. Now, however, during good times, it has expanded again. This is the opposite of good recession preparedness.

Number of employees. During the recession, firms shed 7.1% of their employees. However, revenues dropped 9.4%. Now revenues have climbed to 7.8% above 2007 levels but the workforce has ballooned to 16.7% above 2007 levels. In our survey, 33 companies increased their headcount faster than their revenues between 2007 and 2018 and nine of them increased headcount more than twice as fast as revenues. The number of employees fell too slowly during the recession and rose too fast during the recovery. It is easy to add people during good times but much harder and more painful to get rid of them during a recession. This greatly dampens efforts to scale back costs and is very dangerous heading into a recession.

Figure 3 summarizes the horizontal analysis including our conclusion about the preparedness in 2018 versus 2007.

FIGURE 2

Explanation of metrics used in the analysis and their impact on recession-readiness

METRICS FOR EACH COMPANY	IMPACT ON RECESSION-READINESS
Revenues (in 2007 bill $)	Usually the higher the better
Profitability (net income/revenue)	Higher is better
How leveraged? (total liability/total assets)	Lower is better, less debt is desirable
Working capital (in 2007 bill $)	Usually higher is better but in a recession some current assets (inventory, A/R) are much less liquid
Variable cost structure (COGS/PP&E)	Higher is better, more resilient.
Revenue per employee (in 2007 $K)	Higher is better.
Accounts receivable (expressed as DSO, days sales outstanding)	Lower is better.
Number of employees	Lower is better. This part of the cost structure is very hard to reduce quickly.

Source: Authors

Vertical analysis

In the vertical analysis, we compared each company to itself over time by looking at all the metrics for one company at a time. We calculated the percent change in each metric for 1.) 2007 vs. 2009 and 2.) 2007 vs. 2018. The first

FIGURE 3

The average values of metrics for 100 U.S. companies in the horizontal analysis

METRICS	AVERAGE VALUES 2007	2009	2018	IS 2018 STRONGER OR WEAKER THAN IN 2007?
Revenues B (in 2007 $)	**3.32**	**3.01**	**3.58**	Stronger
Profitability (net income/revenue)	**6.8%**	**3.6%**	**5.8%**	Slightly weaker
How leveraged? (total liability/total assets)	**0.43**	**0.46**	**0.49**	Slightly weaker
Working capital $B (in 2007 $)	**0.62**	**0.83**	**1.15**	Mixed message
Variable cost structure (COGS/PP&E)	**3.72**	**2.36**	**2.26**	Weaker
Revenue per employee ($K)	**331**	**303**	**308**	Weaker
Accounts receivable (as days sales outstanding)	**58.1**	**56.5**	**60.9**	Slightly weaker
Number of employees	**10266**	**9538**	**11980**	Weaker

Source: Authors

comparison tells us how much the company suffered during the recession and the second tells us how they stand today vs. the year before the last recession. For each metric, we classified the percent change for each company into one of four categories based on these criteria:

- significantly better (the percentage of change was more than +15%);
- not much change (the percentage of change was between +15% to -15%);
- slightly worse (the percentage of change was between -15% to -30%); or
- significantly worse: (the percentage of change is smaller than -30%.

Each company could then have a mixture of some metrics that were significantly better, some with no change, some slightly worse and some significantly worse. We did not include the "number of employees" in this part of the analysis because it was already partially accounted for in the metric "revenue/employee."

To aggregate the overall impact of these seven metrics we invented a weighting method. Not all metrics have the same importance. For guidance, we studied the weighting methods used by the credit rating agencies including Moody's, Standard & Poor, and Dun & Bradstreet. We then assigned the following weights: revenues 25, profitability 30, leverage 10, working capital 10, variable cost structure 15, revenue per employee 5, and accounts receivable 5 for a total of 100 points. Note that these weights reflect only the informed opinions of the authors and other investigators may well invent different weighting methods.

So how did the firms do? How many companies are in each category?

Significantly better. Not all firms suffer in a recession. In fact, 19% did significantly better during the recession, meaning that their metrics were at least 15% better. And it shows that 26% of the firms are now in much better shape to withstand a recession than they were in 2007.

Not much change. Similarly, about 29% of the firms had not much change during the recession meaning that their metrics were within a range of +15% to -15% of pre-recession levels. Overall, that means that nearly half of the firms surveyed did either better or no worse during the recession. This is surprising because the general impression was that nearly every firm suffered.

Significantly worse. That said, one-third of companies did significantly worse during the recession—their metrics were at least 30% below pre-recession levels. And 19% of the companies are now in worse shape to withstand a recession than in 2007.

Mixed signals. Finally, many of the companies surveyed had mixed signals, some metrics positive and some negative preventing us from drawing any conclusions about their recession readiness.

We also wanted to test the resiliency of specific groups of companies: How did those who suffered do? What about those who did not suffer? Did their experience during the recession cause them to behave differently now?

Group 1: Significantly worse in 2009 but now significantly better than in 2007. Recall our initial question: "Have companies learned anything about recession preparedness from the severe 2008-2010 recession?" From our survey, only about 9% of the companies both suffered significantly in the last recession and are now in a better position to withstand the next one. One would hope for a larger percentage.

Group 2: *Significantly worse in 2009 and now no change from 2007.* There are another 4% of companies who both suffered significantly in the last recession and are in the same position now as they were in 2007.

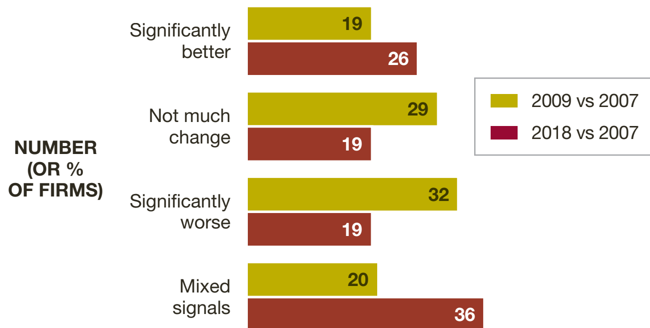
Group 3: *Significantly worse in 2009 and now significantly worse than in 2007.* In addition, 10% of companies both suffered significantly during the last recession and

now after 10 years of good times are actually in a worse position to withstand the next recession. Overall then, we have 14% of the companies who both suffered then and have not improved their preparedness now.

FIGURE 4

Results of the vertical analysis

(Performance versus 2007)



Source: Authors

Group 4: *Better or no change in 2009 and now significantly better than in 2007.* We have 11% that both did not suffer during the last recession and are now in an even stronger position to fend off the next one.

Group 5: *Better or no change in 2009 and now significantly worse than in 2007.* Conversely, we have 6% of the companies who both did not suffer during the last recession but are now in worse shape than they were in 2007.

Where we stand today

The horizontal analysis showed us that overall, based on averages, companies are stronger on one metric, slightly weaker on three metrics, and weaker on three metrics. The main takeaways are:

- revenues have increased nicely but at the expense of lower profits;
- companies took on more debt during the recession and are continuing that trend;
- companies have moved to a less variable cost structure and thus less resiliency; and
- headcounts were hard to shrink during the recession and have now risen faster than revenues.

The combined message of the horizontal analysis is that overall companies are in a weaker position now than in 2007 to withstand the stress of a recession. However, individual companies can be in much better, the same, or in worse shape now than in 2007.

The vertical analysis is a little brighter. We see that 26 companies are in better shape compared to 19 companies that are in worse shape. However, 19 companies are in the same shape and 36 companies have metrics that are a mixture of very good and very bad. In terms of specific groups, we see that only nine companies who suffered during the recession are in better shape now to take on the next recession than they were in 2007. We hoped that this would be a much bigger number, that companies learned some lessons to make themselves more recession-ready. By contrast, 14 companies who suffered are now in the same or worse position than they were in 2007.

So, did we learn anything? Is it different this time? No doubt many companies have adopted better practices influenced by the turmoil of 2009-2013. It would be meaningful to repeat this study with 1,000 companies, enough to draw statistically significant conclusions. But for our study, we do not see a large movement of the metrics or the individual companies in the right direction for recession preparedness. Human nature and the drug of good times are likely too powerful to overcome.

FIGURE 5

Summary of the performance of specific groups of companies

GROUP	DESCRIPTION OF EACH GROUP	NUMBER (OR %) OF COMPANIES
1	Companies who **suffered in 2009** but now are in **better shape in 2018** than they were in 2007	9
2	Companies who **suffered in 2009** but now are in **the same shape in 2018** than they were in 2007	4
3	Companies who **suffered in 2009** but now are in **worse shape in 2018** than they were in 2007	10
4	Companies who **did not suffer in 2009** but now are in **better shape in 2018** than they were in 2007	11
5	Companies who **did not suffer in 2009** but now are in **worse shape in 2018** than they were in 2007	6

Source: Authors

***Part 1, "Is your supply chain ready for the next recession?" can be accessed at scmr.com/article/is_your_supply_chain_ready_for_the_next_recession.*

5 lessons for s

For many supply chain executives, the Financial Crisis was one of the toughest challenges of their careers. Firms across industries were required to deal with huge demand-supply mismatches caused by collapsing demand. However, the supply chain community found innovative ways to deal with the challenges of these tough times. Here are five lessons from that crisis.

BY KAI HOBERG AND KNUT ALICKE

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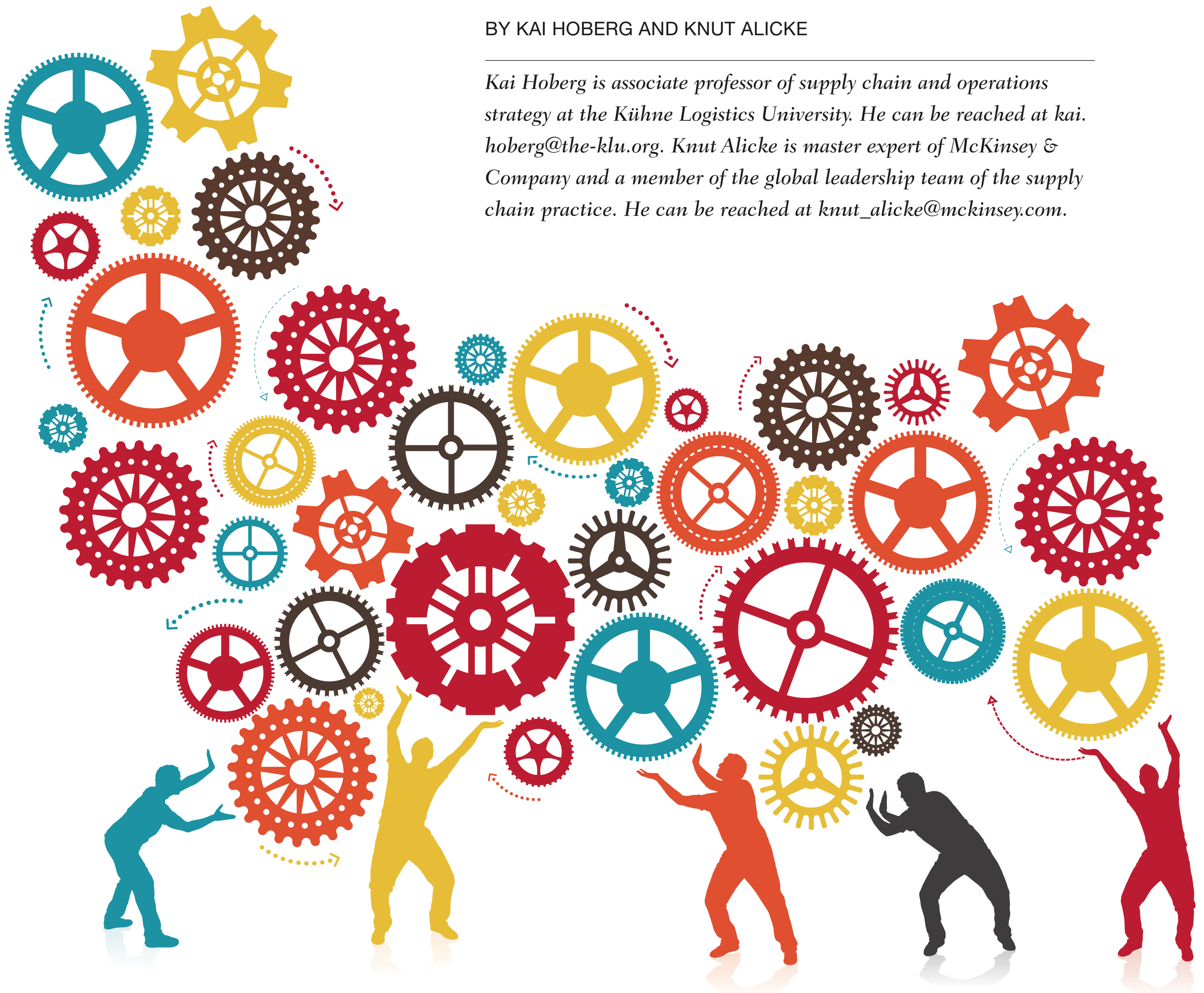


supply chains *from the* Financial Crisis

Firms have always been challenged to adapt their supply chains to their success in the market. During boom periods, firms are eager to avoid costly backlogs, to align manufacturing capacities with growing demand, and to ensure raw materials from new suppliers. Meanwhile, supply chains are accelerated, costly air freight is accepted, and large batches are produced because goods will be sold at some stage. In contrast, during difficult times, firms must address shrinking customer orders, face increasing competition, and see decreasing margins. Accordingly, priorities for supply chains differ significantly. Firms must focus on cutting costs, reducing capacities, consolidating suppliers, and freeing up cash by taking out inventory.

Difficult times frequently relate to an individual firm's situation: These could include poor top management decisions, cost pressures from a new competitor, or demand being hit by poor customer service. However, difficult times are also frequently caused by changing economic climates.

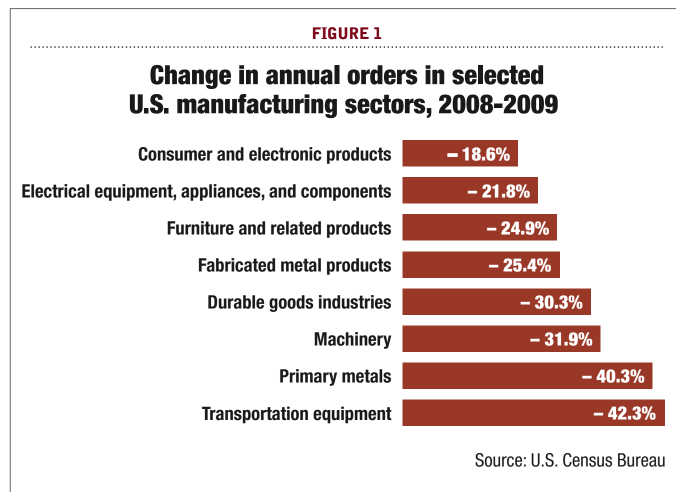
During the Financial Crisis that started five years ago, an unforeseen contraction in demand across numerous industries challenged supply chains globally beyond anything observed in the past. As the economy continued to drift downward, a significant turning point occurred on September 15, 2008, when Lehman Brothers, the fourth largest U.S. investment bank at that time, declared bankruptcy. The collapse of Lehman Brothers sent a shockwave through the financial world and triggered an unprecedented decline in the global economy.

In particular, the manufacturing sector suffered severe consequences as a result of the recession: Industries such as machinery, metals, and transportation equipment observed drops in customer orders by up to 42% within a single year (see Figure 1). Many companies struggled to survive and entire supply chains were threatened with collapse. Those firms that survived the Financial Crisis reacted swiftly and decisively. Often, they leveraged innovative approaches to safeguard their internal and external supply chains amid the challenging business climate.

Today, many firms continue to deal with individual challenges. Similarly, the economic situation in many parts of the world has become unstable. For those reasons, innovative approaches for managing supply chains in a downturn could become as important now as they were just five years ago. Based on a series of interviews with executives from numerous firms affected in the Financial Crisis, we identified five action areas supply chain executives should be familiar with.

FIGURE 1

Change in annual orders in selected U.S. manufacturing sectors, 2008-2009



Source: U.S. Census Bureau

Supply chain actions in difficult times

Management actions in difficult times are well known and are typically in line with classic turnaround approaches. These actions include engaging in significant cost reduction (including overhead costs), introducing zero-based budgets, establishing war rooms, and redefining footprints and networks. However, it is also crucial to understand the trade-offs between myopic and sustainable actions. In addition, it is key to plan for the inevitable and prepare the supply chain to deal with tough times.

For example, when a mid-sized third tier automotive supplier in Southern Germany was confronted with significant demand reductions, the company reacted quickly. The supplier closed one production site, shifted production volumes to low-cost countries, and furloughed employees to adjust to the decrease in volume. Unfortunately, the specific knowledge that was required to establish new production lines was not transferred. Moreover, the company went through a lean manufacturing program, setting inventory holding cost at a high level of 40%, which was excessive for its low to medium value-dense products. Although all of the crisis measures were appropriate, applying the measures in parallel placed the company under severe pressure, causing the firm to deplete its cash stores near to the point of bankruptcy.

In a supply chain context, the five action areas that are illustrated in Figure 2 are essential to cope with any type of crisis situation—individual as well as economic. First, supply chain managers should gain a clear understanding of potential demand scenarios, as demand should be the basis of all supply chain planning. Second, firms should safeguard their supplies to avoid any critical bottlenecks as suppliers go out of business. Third, firms must accelerate all efforts to create flexible and breathing supply chains that can cope with all types of variability. Fourth, managers should carefully reduce inventories to free up cash that is essential for turnaround actions. Finally, firms should also consider the light at the end of the tunnel and should begin to position themselves for the inevitable upswing.

Based on our experience, all five action areas must be considered in parallel, which will cause exceptional challenges for supply chain managers while also dealing with all types of operational glitches. Accordingly, we believe that firms should begin to prepare as early as possible for difficult times ahead. In the end, they will not only benefit in the crisis but actions are also beneficial to the business from a long-term perspective.

Understanding true demand

One key lesson from the Financial Crisis was that numerous firms underestimated the severity of the declines in demand, which reached 90% in some firms. Because forecasting demand is the starting point of all planning (i.e., capacity planning, supply planning, and production planning), it is crucial to understand true demand. Indeed, any significant over- or under-reaction could trigger a disaster. Accordingly, successful companies have pursued three key actions to improve their understanding of demand: (i) identifying reliable demand information, (ii) communicating with customers, and (iii) developing demand scenarios.

Identify reliable demand information. For most firms, the visibility of true customer demand was close to zero at the beginning of the crisis. Many found it challenging to *identify reliable demand information*. In addition to high levels of economic uncertainty, opportunistic competitor actions to fill capacities induced additional uncertainty. Even long-standing orders were subject to cancellation as a result of collapsing customer demand. For example, a Scandinavian heavy equipment manufacturer lost nearly all previously booked orders from Russia because of limited credit availability of these customers. For this reason, successful firms establish a process to monitor the probability of order cancellations that is similar to the processes for monitoring the probability for winning orders. Frequently, companies began to realize that leveraging information from the over-opportunistic sales force did not provide any transparency, as sales personnel were still handcuffed to their

FIGURE 2

Action areas for supply chain management during periods of economic crisis

	Action Area	Key Actions
1	Understanding true demand	• Identify reliable information • Communicate with customers • Develop demand scenarios
2	Monitoring and safeguarding supply	• Identify supplier criticality • Monitor supplier health and lead times • Ensure the survival of critical suppliers
3	Creating flexible, breathing supply chains	• Understand the effects of demand fluctuations • Convert fixed costs into variable costs • Define smart contracts
4	Aligning inventories to free up cash	• Avoid surplus-inventory intake • Align inventory policies • Streamline service offerings
5	Preparing for upswing	• Retain and develop talent • Prepare long-term projects • Provide upside capacity

budget thinking. When challenged to explain their sales forecasts, personnel often expressed concerns that capacity could be reduced too sharply and that longer lead times would alienate customers. Successful firms rapidly moved away from initial budgets and targets by implementing a new zero-based budgeting process.

Communicate frequently with customers. Numerous companies also established *more frequent communication with customers* and placed more emphasis on short-term forecasts. When the symptoms of recession began to emerge, one automotive supplier reduced the firm's forecast horizon, and sales personnel increased chatter with customers. However, communication through established channels between sales and procurement departments often did not provide sufficient visibility, as the information flow was slow within the customer organization. Procurement departments themselves frequently had no visibility regarding procurement volumes in the upcoming weeks and months. Accordingly, increased direct communication began to occur among planning departments while contract details were coordinated between sales and procurement departments. Some companies also began to further integrate planning systems and established EDI to obtain real-time updates on planned volumes.

Another example of effective communication is a vertically integrated chemical company based in Germany that produces goods for all stages of the chemical value chain. By sharing demand information on all types of fine and base chemicals internally, managers established a reasonable picture of the market demand for different products several months in advance.

Prepare multiple demand scenarios. Because of limited visibility, a single forecast for a product line was often difficult to obtain. Therefore, successful companies began to *prepare multiple demand scenarios* and to plan their actions within these scenarios. Such scenarios included consideration of the following questions:

- Is the worst case that demand decreases by more than 80%?
- What is the outcome if all of our customers in France close their plants for three months?
- What are the aggregated inventories of all European customers, and would these customers need to divest all of their stocks?
- How long can we employ our workers given the current order book and the lack of new demand?

We believe that firms should begin to prepare as early as possible for difficult times ahead. **In the end, they will not only benefit in the crisis but actions are also beneficial to the business from a long-term perspective.**

Top companies have endeavored to answer these types of questions and have typically aggregated them into a few scenarios. Several companies have even developed more advanced economic models to analyze the effects of early indicators on the world economy and to develop scenarios and action steps accordingly.

Monitoring and safeguarding supply

The suddenness and severity of the recession forced many firms to the brink of bankruptcy. While sales and demand reached all-time lows, sourcing departments faced an entirely new challenge—the risk of losing suppliers and entire supply chains due to bankruptcy.

Accordingly, successful firms exerted significant efforts to safeguard their supply. Typically, they implemented an advanced supplier risk management system that included three actions: (i) identifying supplier criticality; (ii) monitoring supplier health and lead times; and (iii) ensuring the survival of critical suppliers.

Identify supplier criticality. Although most firms have established a regular risk assessment and management process, these processes typically focus on physical supply chain disruptions such as natural disasters or strikes. The risk of losing suppliers next door is often neglected. Therefore, *supplier criticality needed to be reevaluated* based on the risk of supplier insolvency. Which critical parts and how much volume do we obtain from a supplier? Which alternative suppliers are certified? What volumes can these alternative suppliers provide? Who owns the tools and forms?

Often, second-tier suppliers and subcontractors also contributed to the problem, particularly in the automotive industry. For this reason, firms that had prepared supply chain mapping scenarios could now more easily identify the potential effects of supplier defaults.

Numerous firms underestimated the severity of the declines in demand, which reached 90% in some firms.

Monitor supplier health and lead times. Once supplier criticality was identified, firms were required to *monitor supplier health and lead times*. To monitor supplier health, successful firms leveraged all types of internal and external sources, such as buyers' information on the speed at which suppliers were committing to orders or requesting earlier payments, information from plant visits regarding utilization, and newspaper/industry discussions on sell-and-lease-back deals or the loss of key people to understand the "real" situation of the supplier. Additionally, many firms carefully reviewed the quarterly financial statements of their suppliers. In any scenario, the monitoring of suppliers must be carefully coordinated, including the identification of lead persons who collect all information.

In addition to supplier health, successful firms also carefully reviewed supplier lead times. Low order intake often had an inverse effect on lead times because suppliers reduced their capacities to stretch their order books over longer periods. Therefore, firms needed to proactively align with suppliers with respect to new delivery schedules.

Ensure the survival of critical suppliers. Communicating frequently with suppliers and being a "good" customer is often beneficial for firms during more comfortable financial times. Paying invoices on time rather than stretching payment terms can ensure a preferred customer rating that allows additional favors in the future. Nevertheless, several companies have been forced to *ensure the survival of critical suppliers*. In instances where no alternative suppliers for critical goods were (yet) available, firms supported suppliers by pooling spending or taking inventory ownership from suppliers to ease their financial burdens. Particularly in small oligopoly supply markets, firms have tended to prefer supporting a struggling supplier rather than coping with an even more concentrated supply base in the future. In extreme cases, firms also attempted to actively reshape their supply base according to their strategic objectives. For example, one automotive OEM defined its preferred supplier landscape for a certain category and actively reallocated sourcing spending to the preferred suppliers, thereby destabilizing out-of-favor suppliers and rendering them easy acquisition targets.

Creating flexible, breathing supply chains

When demand plunged in the Financial Crisis, numerous firms grappled with overcapacity and struggled to right-size their operations in the short term. These challenges were often inevitable because network design and footprint decisions had been carefully planned and implemented over the course of several years for a very specific demand scenario. For the future, we suggest managers proactively address demand uncertainty and create supply chains that are flexible to a wider range of demand. We use the term breathing supply chains for setups that can efficiently provide output at different quantities. Breathing supply chains are also a means to deal with fluctuations in more regular operations. We find that successful companies pursued three key actions to implement them: (i) understanding the effects of demand fluctuations; (ii) converting fixed costs into variable costs; and (iii) defining smart contracts.

Understand effects of demand fluctuation. One key task in defining supply chains is to match capacity with demand. Accordingly, it is crucial to obtain a fair *understanding of the effects of demand fluctuations.* Firms must identify which actions should be selected based on the prepared demand scenarios and must embed the breathing supply chain thinking into their supply chain strategies by asking questions such as: How do we provide the most flexibility regarding any changes in demand?

For each demand scenario, a firm must identify preferable actions that holistically consider the effects of selling, closing, or idling manufacturing assets as well as any potential insourcing or outsourcing effects. On a more operational basis, situations are frequently complicated by increased MRP complexity in low-demand situations as a result of coupled production, minimum batch sizes, and order quantities.

Convert fixed costs into variable costs. Ultimately, it is crucial to *convert fixed costs into variable costs* to compensate for lower production levels by diminishing marginal costs. Firms have often closed or idled assets with lower productivity while carefully considering the incremental costs of moving production to other plants. One alternative for reducing fixed costs involves increasing the utilization of "fixed" assets and labor by insourcing. Whereas outsourcing has become a common practice for addressing bottlenecks and reducing costs in normal economic conditions, many firms have focused on insourcing during the Financial Crisis. For example, for firms

in the machinery sector, insourcing standard manufacturing processes, such as milling, welding, or assembly operations, appears to be rather simple. Through insourcing, firms were able to increase worker and asset utilization even when internal productivity was lower. However, firms must minimize insourcing costs by cross-training workers, maintaining the required tools, and developing smart contracts that avoid penalties.

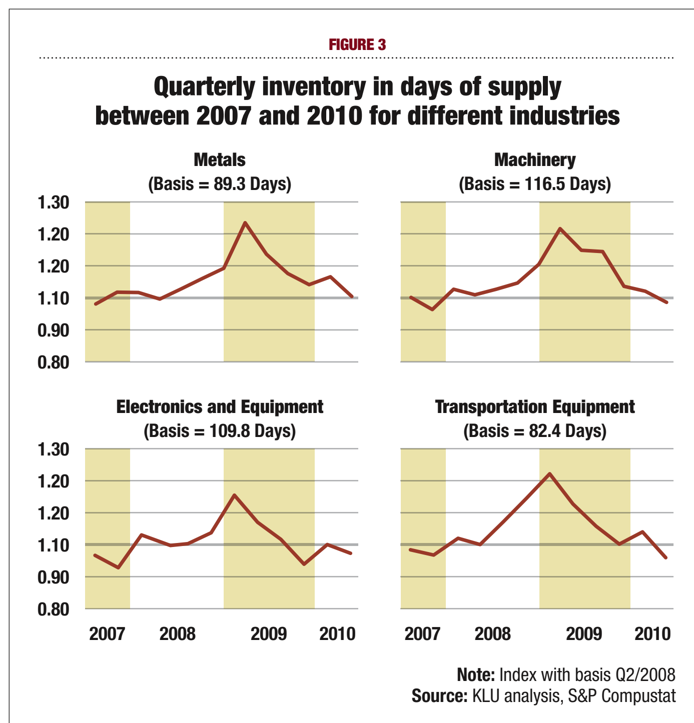
Define smart contracts. The *definition of smart contracts* with suppliers plays a crucial role in creating breathing supply chains. Many firms closed long-term contracts with suppliers to benefit from discounts. However, once locked in, volume or price reductions often depend entirely on the good will of suppliers. Successful companies have considered fluctuations in demand when defining their contracts. For example, one Dutch chemical company had an annual contract with a provider of tank capacity beginning on January 1. The firm received a volume discount based on the tank capacity signed for the year. However, company officials realized that the firm would need to pay for unused tanks or would fail to receive volume discounts if capacity requirements deviated from the plan in mid-year. Therefore, the firm opted for a smart contract design. Rather than renting all tank capacity on January 1, the firm now begins its annual rents on a rolling basis throughout the year (e.g., certain capacity on January 1, certain capacity on February 1). Rather than receiving a volume discount on the capacity signed at the same time, the discount is now based on the capacity rented at a given time. The firm can easily discontinue the rent for the tank with the next expiring contract to adjust capacity while continuing to receive high-volume discounts for the remaining tanks rented. The example highlights the importance of considering your options before any crisis arises to ensure flexibility in tough times.

Aligning inventories to free up cash

Reducing inventories while meeting service-level requirements has always been a key challenge for supply chain managers. However, the limited availability of credit during the Financial Crisis triggered a skyrocketing interest in optimizing inventories, as firms were required to free up significant amounts of cash on short notice. The situation became even more challenging as a result of unfavorable inventory dynamics. A significant reduction in sales slowed the outflow of goods to customers; customers were consuming their usual inventories at a lower rate and additionally reduced their safety stock levels to a lower level, thus triggering a multiplier effect. Accordingly, supplier production plummeted, and firms could only gradually consume their raw material stocks. As a result, many firms observed the characteristic inventory hump (see Figure 3). Inventories hit the roof across industries in 2009 and increased by up to 70% within six months until the trajectory reversed.

FIGURE 3

Quarterly inventory in days of supply between 2007 and 2010 for different industries



Note: Index with basis Q2/2008
Source: KLU analysis, S&P Compustat

Our interviews with successful inventory managers highlight three practices that enabled managers to avoid or at least to balance the inventory hump: (i) avoiding surplus inventory intake; (ii) aligning inventory policies; and (iii) managing service offerings.

Avoid surplus inventory intake. Although inventory managers have few options to increase the sales that trigger the outflow of goods, it is essential to *halt the inflow of surplus goods* that will require a long time to turn. We found that successful firms reacted firmly to the decrease in demand and implemented a moratorium on material orders to avoid any intake of surplus goods. Similar to a travel ban, firms reviewed all material orders against their demand scenarios and scrutinized their supplier contracts for cancellation opportunities. Even if contracts did not allow for order cancellations, firms often successfully negotiated with suppliers to extend volume commitments over longer periods of time. Several companies also managed to sell raw materials to other manufacturers that in turn benefited from favorable prices.

Align inventory policies. The significant change in demand required numerous firms to review and *align their*

Address demand uncertainty and create supply chains that are flexible to a wider range of demand. We use the term breathing supply chains for setups that can efficiently provide output at different quantities.

inventory policies. Frequently, order quantities were reviewed and reduced. For example, one leading European automotive supplier changed the typical order size for a certain category from full truckload to half truckload in an effort to minimize cycle inventory. Likewise, firms reduced their batch quantities in accordance with the new demand reality, which required more frequent changeovers. However, surplus personnel were available at virtually no incremental cost. Further, an increasing number of firms implemented analytical safety stock targets to avoid or reduce safety stocks and aligned their processes based on the management of slow moving items.

Streamline service offerings. Finally, successful firms streamlined their service offerings to customers based on their value-add. One well-known trade-off in inventory management relates to the service level that is offered to customers: higher service-level targets require greater safety stock inventory. During the crisis, successful firms reduced their service levels to move from a full-service to a cost-efficient setup. In one case, a supplier to the furniture industry reduced service levels from 98% to 90% unless products were in heavy competition, provided significant value-add, or customers were willing to pay a premium for higher service level.

Furthermore, firms aligned their Make To Stock/Make To Order (MTS/MTO) mix to eliminate inventories, particularly for SKUs that were sold to a single customer only. However, this approach required careful communication with customers, as they were required to plan and order these now-MTO items further in advance. After the crisis many companies relaxed their strict standards on the service offering while successful firms introduced new processes to carefully evaluate which items to really serve from stock.

Preparing for the upswing

As the Financial Crisis began to ease in 2009, numerous managers were caught by surprise by the sudden economic upturn. For example, the demand plan of one transportation equipment company suggested a slow return to pre-crisis demand levels over the course of six years. Nevertheless, in less than two years, demand bumped back to the previous dizzying heights. Likewise, many firms were still in the right-sizing mode and realized the challenges of moving from full reverse to full steam ahead as production capacities had been reduced and talent had been released. However, far-sighted firms were prepared for the upturn and managed to gain significant market share by meeting customer demand while competitors struggled. We have identified three practices that enabled firms to successfully meet the increased demand at the end of the crisis: (i) retaining and developing talent; (ii) preparing long-term projects; and (iii) providing upside capacity.

Retain and develop talent. Although the length of the crisis was unclear to most managers, many successful firms realized the utmost importance of *retaining and developing talent* throughout the recession. Because manufacturing processes in many countries have become more complex in recent decades, the importance of expertise has similarly skyrocketed. Although firms had to lay off workers while adjusting their capacity, talent retention was crucial for the eventual upturn. Many firms reduced employee work hours to ensure that the given order book provided sufficient cover to retain key personnel. Another successful example is Germany's chemical and automotive industry, in which many firms leveraged government-supported part-time work to avoid layoffs (1.47 million employees were operating under part-time government support in May 2009 compared to 0.05 million in May 2008). The ability to retain talent enabled the firms to rebound as the economy began to recover.

Prepare long-term initiatives. Many firms realized that the downturn could also be viewed as an opportunity to *prepare long-term initiatives* as long as no significant investments were

involved. In the boom years before the financial crisis, many firms did not have the resources necessary to carefully review their supply chains, as skilled experts were struggling to maintain pace with business expansion. However, the sudden downturn halted further expansions and provided firms with breathing space to focus on long-term initiatives. For example, one consumer packaged goods manufacturer reevaluated its manufacturing footprint using the newly available project management capacities that were implemented as investments became available at the end of the downturn.

Provide upside capacity. When planning for business in the Financial Crisis, many firms did not consider the need to *provide upside capacity.* Although suppliers were frequently required to retain some capacity on standby to prepare for sudden demand increases, many firms did not sufficiently prepare for this scenario and were surprised by labor and asset shortages. One example of upside capacity is provided by a chemical company that needed to employ temporary workers during the upturn. By paying a temporary employment agency a small standby fee for the preferred provision of personnel, the firm was able to select the temporary workers first when the economy began to recover. Accordingly, the firm was able to take on the temporary workers who had previously been working in the firm, thus minimizing the ramp-up time. Other examples include firms that were able to secure capacity early at key suppliers because they sensed the upcoming increase in demand rather quickly.

Being agile

Many firms suffered seriously or closed their business during the Financial Crisis: They did not reduce capacity as rapidly as demand plummeted; they lost critical suppliers and thus could not fill customer demand; they nearly went bankrupt because of high inventory levels and a lack of cash; they did not have the talent or the capacity to fill soaring demand and therefore lost market share.

Were these outcomes purely the result of misfortune? In some cases, misfortune was perhaps to blame; however, we believe that the Financial Crisis harshly revealed the weak points in many firms' supply chains. Based on our experience, we highlighted five key areas that many firms did not sufficiently address. These five key areas are not necessarily crisis-related. In fact, successful companies do not require significant changes because these firms already address these topics. However, firms that do not consistently consider these key areas are much more vulnerable in downturns. What does this finding mean for the next crisis—economic or on an individual firm level?

First, firms must always be carefully scanning for major changes in its specific market conditions or in the overall economic climate. Managers must ensure demand transparency, establish early warning mechanisms using internal and external data, and reconcile with other functions as well as suppliers and customers. To accomplish these goals, managers must establish the relevant processes.

In addition, firms must constantly challenge and test their abilities to adapt to major changes in demand and supply. One valuable tool is an agility assessment of the supply chain to determine whether a firm is truly prepared for an inevitable downturn. Numerous firms have already embedded semi-annual or annual agility assessments into their routine risk management processes. In this context, alternative demand scenarios are outlined, and supply chain adaptations and contingency plans may be developed.

Overall, we believe that firms should continuously improve their agility, which is a means of ensuring success in any economic situation. Fewer stockpiles are accumulated when state-of-the-art inventory management policies are implemented, capacity can be adjusted quickly when contracts with suppliers are designed intelligently, and supplier bankruptcies can be handled easily when alternative sources are constantly identified. For firms that have not yet become sufficiently adaptable in this regard, now is the proper time to begin working on the measures recommended here—in other words, before the next crisis.

End Notes

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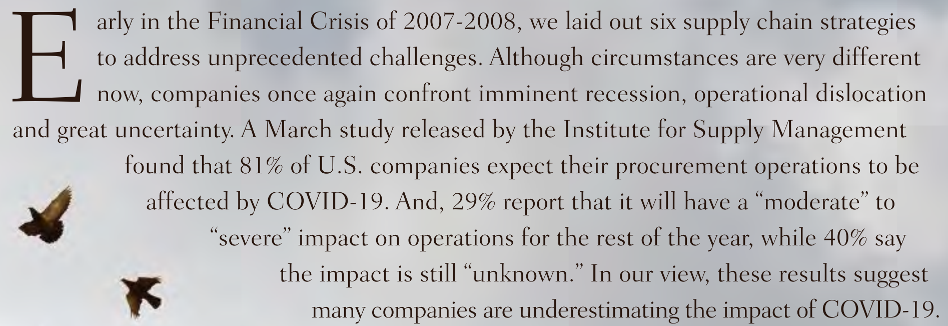
Negotiating the ECONOMIC DOWNTURN

These six supply chain strategies can carry you through difficult times.

BY JONATHAN HUGHES



Early in the Financial Crisis of 2007-2008, we laid out six supply chain strategies to address unprecedented challenges. Although circumstances are very different now, companies once again confront imminent recession, operational dislocation and great uncertainty. A March study released by the Institute for Supply Management found that 81% of U.S. companies expect their procurement operations to be affected by COVID-19. And, 29% report that it will have a "moderate" to "severe" impact on operations for the rest of the year, while 40% say the impact is still "unknown." In our view, these results suggest many companies are underestimating the impact of COVID-19.

Jonathan Hughes is a partner with the Boston-based consulting firm Vantage Partners. This article, originally published following the 2008 Financial Crisis, has been updated to address the challenges faced by procurement organizations during COVID-19. Hughes can be reached at jhughes@vantagepartners.com.

Pressure to reduce costs is escalating rapidly, but procurement and supply chain management groups also need to ensure supply chain continuity, safeguard the viability of key suppliers and retain the ability to pivot, and scale up production and business activity as we come through the current crisis and enter recovery. Below we reprise and update strategies we shared in 2007-2008 as a playbook for navigating turbulent times.

1. Revisit supplier agreements—and take a collaborative approach to negotiations.

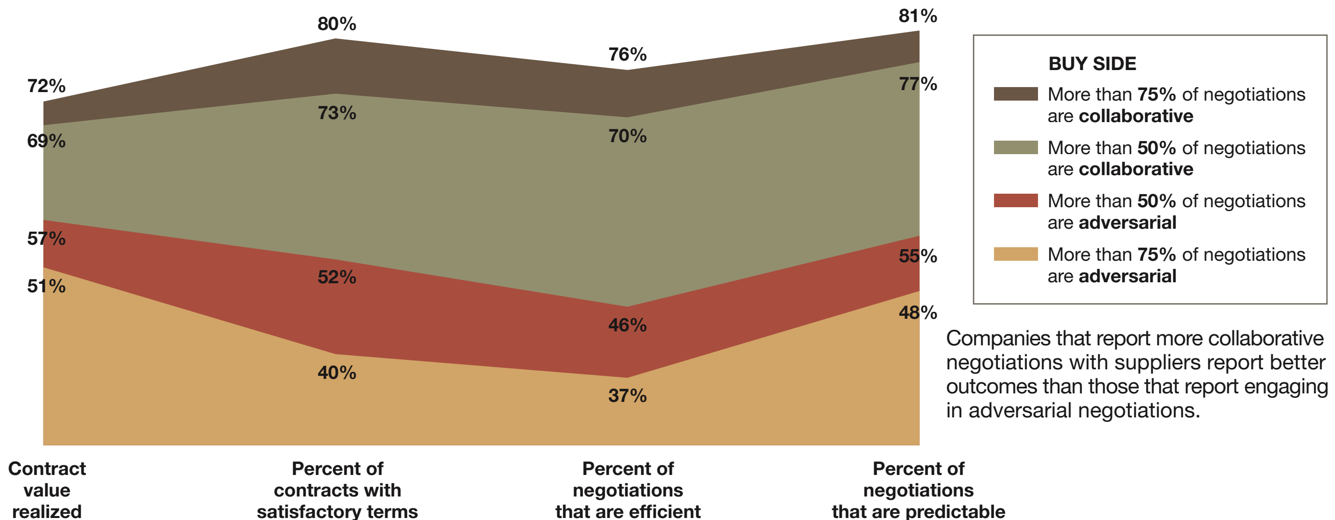
Many companies are finding themselves saddled with supply contracts that have been rendered obsolete by abrupt changes in market conditions. We caution against what some companies are doing, namely, refusing to take delivery of contracted volumes and/or demanding price reductions. Rather, we suggest that companies systematically analyze their major supply contracts to determine if there is a legitimate basis for renegotiation, and if so, engage negotiations in a collaborative fashion. For example, many current supplier contracts are based on peak commodity, material and labor costs. Particularly when companies agreed to high pricing based on high supplier input costs, and markets where demand significantly exceeded supply, customers have a reasonable basis to open discussions with suppliers.

Acting with urgency and speed is critical. The longer customers and their key suppliers take to adjust, the more painful those adjustments will be—and the more limited the options will be for customers. Consider that the COVID-19 crisis began (unlike the Financial Crisis) as a supply-side disruption. Social distancing policies have now massively reduced economic activity, and we now see typical recessionary reductions in demand. But a third phase of disruption is coming. As many suppliers, especially small and medium-sized companies, go out of business, and many remaining suppliers reduce production capacity (shutting down plants and production lines, reducing shifts and furloughing workers), many customers will see an escalation in supply bottlenecks and shortages—even before the recovery begins.

According to an April 8th poll we conducted in collaboration with the Institute of Supply Management, 64% of more than 300 respondents reported an increase in renegotiation of contracts with suppliers, though only 8% reported "a great deal" of renegotiation activity as a result of COVID-19 and related economic dislocation. Based on our research and analysis of the Financial Crisis and recession, we believe many companies are underestimating the number of supply contracts they will need to negotiate, and are at risk of being disadvantaged in those negotiations by not taking urgent action to prepare for them and engage

FIGURE 1

Collaborative versus adversarial negotiations



Companies that report more collaborative negotiations with suppliers report better outcomes than those that report engaging in adversarial negotiations.

Source: Vantage Partners 2018 Customer-Supplier Negotiation Study, with more than 500 responses from more than 300 companies

suppliers earlier—thereby creating more space to negotiate creative solutions with less time pressure. A collaborative approach to negotiations leads to better outcomes (see Figure 1). Sourcing and supply management groups that act quickly, and take a creative and collaborative approach to negotiations, can ensure that they are not put on allocation by key suppliers, even as their competitors are.

2. *Assess and act to safeguard the viability of critical suppliers.*

Regardless of what your company does, many of your suppliers will be facing significant price pressure and reduction in demand from *other* customers. As important as cost reduction is in the current environment, minimizing avoidable revenue losses should also be a key priority. This means that procurement and supply chain management organizations need to place significant emphasis on identifying, and preempting or remediating, supply chain bottlenecks and breakdowns. They also need to ensure that quality and safety standards are not compromised as suppliers come under significant financial pressure and confront disrupted operations and their own supply chain challenges.

Companies that have already invested in creating transparent, high-trust relationships with suppliers, and that put in place supply chain risk monitoring systems, are already reaping benefits. Others must now redouble efforts to reassess risks within their supply base, and work jointly with suppliers to develop and implement risk mitigation strategies. Those companies that have given their suppliers reason to distrust them will find this a difficult task. They are likely to experience costly supply chain disruptions as their suppliers try to protect themselves by hiding risks and problems, rather than collaborating on joint efforts to address them at the earliest sign of trouble.

As our own companies face significant financial pressures, making commitments and investments to support suppliers is not easy. Creative thinking is called for, and many options should be considered. For example, companies with strong cash-flows can accelerate payment to key suppliers that would otherwise need to make major cuts to operations and output. In addition, medium- and long-term purchase commitments to suppliers can sometimes be leveraged by those suppliers to secure loans. There are also opportunities to purchase commodities or parts for suppliers at a lower cost than they can do so on their own. In some cases, there is a compelling business case to make equity investments in critical suppliers, acquire them outright or acquire portions of a key supplier's business. These ideas are further explored below.

3. *Streamline your supply chain.*

A company's supply chain is only as strong as the weakest link, and current economic conditions put disproportionate pressure on weaker suppliers. During periods of growth, many companies find themselves moving too fast to carefully analyze their supply chains and eliminate suppliers that add little value or introduce unnecessary risk. Now is the time to scrutinize distributors and brokers, and aggressively pursue dis-intermediation. While intermediary links in the supply chain provide convenience and (perhaps) increased speed to market in good times, there are three key (interrelated) reasons to subject such suppliers to a high degree of scrutiny.

- **They introduce an extra layer of cost:** When your company was scrambling to keep components coming in the door to meet your customers' orders, benefits may have outweighed the costs; but now is the time to explore efficiencies through better direct linkage with original equipment manufacturer (OEM) suppliers.
- **They complicate and often distort communication between a company and its key OEM suppliers:** That often compromises effective demand and capacity planning, thus introducing further cost and supply continuity risk.
- **They limit the ability of a company to build partnerships with key OEM suppliers,** which in turn limits the ability to creatively reduce costs through specification implication or redesign, materials changes and enhanced joint forecast and demand management.

4. *Enhance cross supply chain collaboration.*

During this new season of uncertainty and economic contraction, some companies will quickly react by squeezing suppliers and/or shifting risk onto them, rather than working with partners across the supply chain to *collectively* reduce total costs and reduce risk for the entire extended value chain. Forward-looking companies are using the economic downturn to engage suppliers in innovative efforts

to achieve cost savings while safeguarding supplier viability—often by forging new links of collaboration across multiple nodes in the supply chain.

Significant opportunities can often be found when companies bring together Tier 1 suppliers along with critical upstream suppliers of raw materials or commodity components. In some cases, significant risks exist because OEMs are critically dependent on certain raw materials (e.g., platinum, nickel, copper, various reagents and reactants)—often purchased in relatively small amounts. Opportunities exist for companies to purchase critical raw materials and basic components, (leveraging spend across multiple categories) and supply them to OEM suppliers, thus reducing cost and risk in a mutually beneficial manner.

Another example: As shipping and logistics capacity has been severely reduced, some companies can provide access and attractive pricing to their suppliers under their own shipping contracts, or access to their own logistics expertise and warehouse capacity. Such arrangements are often complex (and negotiating them is not simple), but they can often produce significant cost savings and risk reduction in the short term, and set the stage for even greater benefits coming out of an economic downturn.

5. Focus on collaborative innovation.
Research that we have conducted over the last two years shows that companies that focus on leveraging external assets and capabilities of suppliers and business partners have experienced significantly higher growth than companies that rely primarily on their own assets and capabilities. Indeed, the top quartile of companies we analyzed (in terms of leveraging external assets and capabilities) generated 285% greater revenue growth compared to the average from 2014-2018.

Recent examples abound of companies acting with striking urgency and flexibility to innovate in response to the current crisis. Dyson (best know for its vacuum cleaners) designed the Covent ventilator in 10 days in collaboration with TPP. Ford worked with Detroit area hospitals, the University of Wisconsin and suppliers to rapidly develop and manufacture a new intubation splatter shield—moving from initial work on design to products in hospitals for testing in a week.

Most supply management professionals see the value in sourcing business solutions and innovation (versus products and discrete services) and believe their companies should do much more. However, there is, and has been, a large gap between those aspirations and reality (see Figure 2).

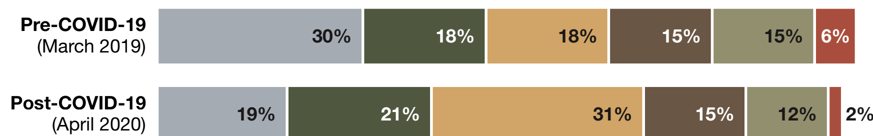
What's fundamentally different about sourcing solutions or innovation? It requires more information-sharing and transparency with suppliers. Rather than figure out internally how to reduce costs or overcome

FIGURE 2

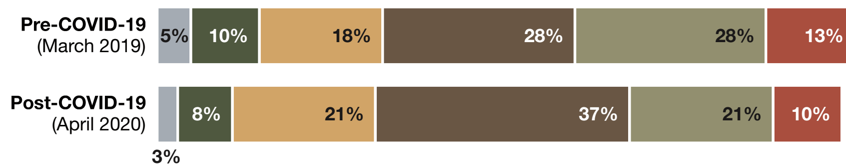
Comparison of pre- and post-COVID-19 sourcing focus

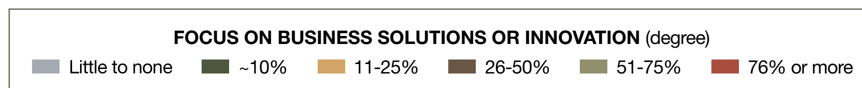
(Percentage of respondents)

How much of your company's sourcing is **currently** focused on business solutions or innovation?



Ideally, how much of your company's sourcing is **should be** focused on business solutions or innovation?





Source: (Pre-COVID) 40 respondents to poll in Vantage Partners-ISM "Future of Sourcing" webinar, March 19, 2019
(COVID) 185 respondents to a poll in Vantage Partners-ISM "Sourcing Innovation" webinar, April 9, 2020

supply chain bottlenecks and *then* ask a supplier to propose how they would implement *your* solution, you explain the problem, and ask for their creative ideas on how to address it. Sourcing innovation requires bringing technical and commercial people, from both customer and supplier, together to identify and explore cost reduction and risk mitigation opportunities. Joint ideation sessions and customer-supplier hackathons need to augment, or replace, traditional RFx processes. Asking different questions is required to find new and innovative solutions.

6. Become a "customer of choice." While each company confronts a unique set of trade-offs between navigating immediate challenges and addressing longer-term opportunities (see Figure 3 for recent data on how companies are striking this balance), becoming a "customer of choice" with key suppliers is equally valuable in good times and bad.

Our research indicates that companies that are seen as easier to do business with and more collaborative are 29 times(!) more likely to get the best people, pricing and ideas from suppliers. Buy-side respondents that put a high priority on creating foundation of mutual trust, understanding and respect with suppliers also report realizing 24% more of the value from their supply contracts compared to those companies that place a low priority on building and maintaining collaborative relationships.

Companies face a window of opportunity during which they might be able to lock in supplier pricing that will provide a cost-advantage as the economy recovers, while *simultaneously* cementing preferred relationships with key suppliers. As companies seek an elusive optimality between supply chain efficiency and resiliency, collaborative relationships with key suppliers offer a way to do both, while avoiding painful and unnecessary trade-offs.

FIGURE 3

To get more value from suppliers, we need to ask different questions

PERFECTLY FINE QUESTIONS

- How do we extract more savings from our suppliers?
- How can we shift more risk to our suppliers?
- How do we define clear requirements for what we want from suppliers?
- How do we get more innovation *from* suppliers to contribute to our company's topline?

DIFFERENT QUESTIONS

- How do our suppliers make money?
- How can we better allocate risk between our company and suppliers and jointly manage risk?
- How can we help suppliers better understand our strategy, business needs and constraints so that they can offer creative solutions?
- How do we create more innovation with suppliers to contribute to our company's top line and bottom line?

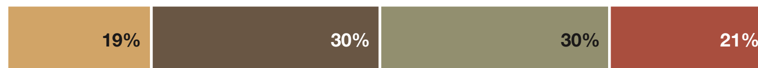
Source: Vantage Partners, LLC

FIGURE 4

Supply management focus, in light of COVID-19

(Percentage of respondents)

How much of your company's supply management efforts are focused on **navigating the current crisis?**



How much of your company's supply management efforts are focused on **planning and acting to position for success as the economy begins to recover?**

Source: 156 respondents to a poll in Vantage Partners-ISM "Sourcing Innovation" webinar, April 9, 2020

Supply chain priorities and COVID-19

Organizations should maintain focus on strategic priorities to make it through current uncertainty and thrive moving forward.

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

At the end of 2019, it was hard to imagine the impact the COVID-19 pandemic would have on supply chains for medical supplies, food and other basic necessities. Although some aspects of supply chains have changed during the pandemic, organizations should not lose sight of core business processes.

In late 2019 and early 2020, APQC conducted a survey of 234 supply chain professionals on supply chain priorities and challenges for 2020. The survey results indicate that there were areas of concern even before the pandemic. The major supply and demand disruptions we have experienced so far this year may exacerbate existing weaknesses in the supply chains of organizations. They also highlight the need for improved processes that can mitigate the impact of global crises.

Marisa Brown is senior principal research lead, supply chain management, APQC. She can be reached at mbrown@apqc.org.

Need for improvement over 2019

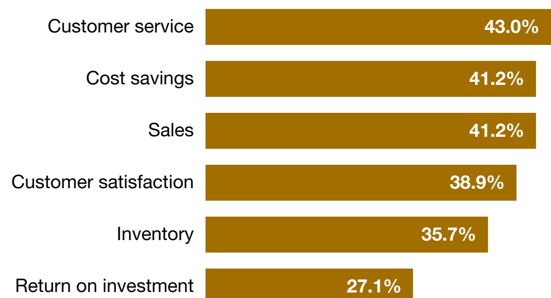
As part of its survey, APQC asked supply chain professionals to look back at their organizations' business results in 2019. The research indicates that last year saw mixed results. When asked whether their organizations were on target to meet, had achieved or had exceeded their business goals for 2019, just over 50% of respondents replied "yes." Similarly, just under 50% of respondents indicated that their organizations were on target with or had exceeded their competitors' performance in 2019.

This means that not only did about half of organizations miss their goals for the year, but nearly the same percentage was unable to keep pace with competitors. Organizations' performance was even worse regarding specific supply chain goals. As shown in Figure 1, fewer than half of organizations achieved their goals in 2019 for customer service, less than 40% met their goals for customer satisfaction and fewer than 30% achieved their goals for return on investment.

These results show that supply chain organizations were in a precarious place even before the impact of COVID-19. Given the rapid economic changes that have happened in the first few months of 2020, the organizations that missed the mark in 2019 are on even shakier ground moving forward. Although organizations must take steps to address any crises they face during the pandemic,

FIGURE 1

Percentage of organizations achieving 2019 goals



Source: APQC

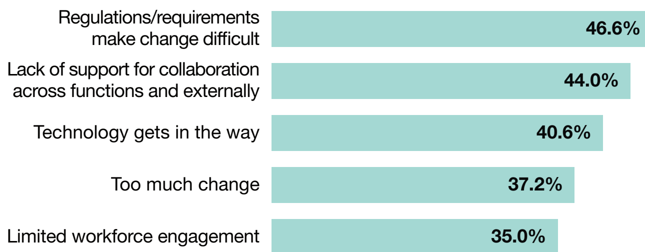
if possible, they should also focus efforts on defining and using processes, measuring performance and ensuring clear accountability and responsibilities. These core competencies will ensure that they can both weather current hardships and succeed once the pandemic has run its course.

Obstacles to improvement

The good news is that more than 81% of organizations are still evaluating and modifying their supply chain strategies to help head off obstacles. This offers hope for supply chain organizations in that they can be flexible enough and adaptable enough to address the current crisis.

FIGURE 2

Top obstacles to improving supply chain processes



Source: APQC

For those organizations that have taken on improvement of their supply chain processes, APQC's survey indicates that they face familiar obstacles to improvement. As shown in Figure 2, the most common obstacle is limitation imposed by regulations and requirements. This is followed by a lack of support for collaboration both across functions and externally.

Although organizations do not have control over regulations, they can influence internal factors such as the lack of support for collaboration, the cultural perception of change and workforce engagement. They can also select technology that best supports improved processes.

Addressing obstacles to improved supply chain practices involves investment to some degree. Whether it is technology that supports better processes or programs aimed at addressing the cultural and engagement aspects of process improvement, organizations must be poised to dedicate resources to supporting process improvement.

APQC's research indicates that many organizations are ready to do just that. Two-thirds of respondents indicated that they expected their organization's 2020 budget for supply chain management tools, technology, innovation and initiatives to increase compared with the previous year. In fact, more than 27% of respondents anticipated that their organizations would increase this budget significantly. Only 10% expected their budget to decrease.

Priorities for 2020

Perhaps because of less than stellar performance in 2019, organizations went into 2020 ready to focus on planning and improvement. In terms of investing resources, innovation and hiring, the top three areas of focus for the year are as follows:

1. ***supply chain planning;***
2. ***sourcing and procurement; and***
3. ***innovation.***

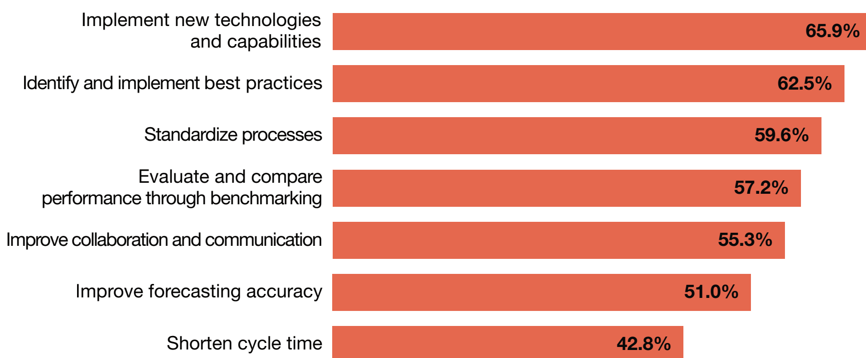
Interestingly, innovation ranked higher in this most recent survey when compared with past supply chain priority surveys conducted by APQC. This indicates that many organizations are looking for new ways to improve their operations and meet more of their goals.

Supply chain planning

Respondents to APQC's survey indicate that, overall, their organizations' primary areas of focus for supply chain planning are demand planning and forecasting, automation and digitization and analytics and measurement. Close behind is sales and operations planning. As shown in Figure 3, organizations have fittingly made implementing new technology and identifying and implementing best practices top priorities in 2020. It is also promising that organizations are making improving collaboration and communication a priority given that this can be an obstacle to improvement.

FIGURE 3

Organizations' 2020 priorities for supply chain planning

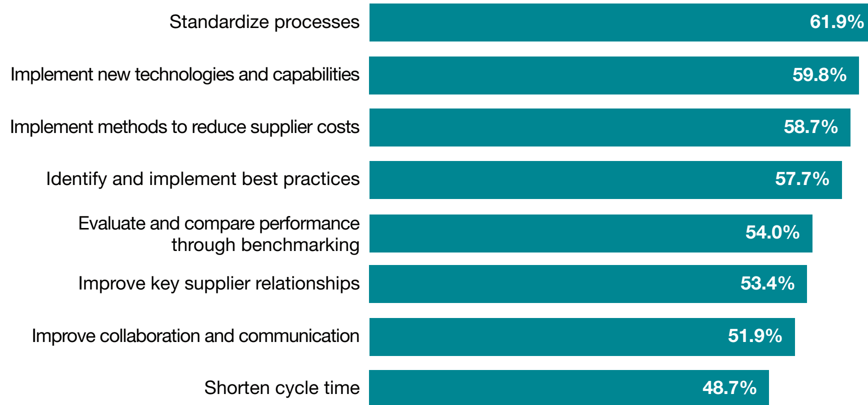


Source: APQC

APQC recommends that organizations maintain their focus on automation and digitization, especially considering the desire to improve demand planning and forecasting, as well as analysis and measurement. APQC also recommends that organizations actively work to identify and implement best practices, as

FIGURE 4

Organizations' 2020 priorities for sourcing and procurement



Source: APQC

well as standardize processes. Any gaps in processes should be addressed to mitigate the effects of supply chain disruptions such as that caused by COVID-19.

Sourcing and procurement

For sourcing and procurement, organizations' primary areas of focus are automation and digitalization, followed by vendor and supplier relationship management. Appropriately, APQC's survey results indicate that organizations are making the standardization of processes and the implementation of new technologies and capabilities their top priorities for sourcing and procurement in 2020 (see Figure 4). The fact that organizations have made process standardization a top priority shows that they are taking an important step toward automation.

More than half of respondents indicate that their organizations have made implementing methods to reduce supplier costs a top priority for 2020. We may see this trend change over the year as organizations look for ways to ensure a steady stream of materials rather than focusing solely on cost.

More than 53% of respondents indicate that their organizations have made improving key supplier relationships and improving collaboration top priorities for this year. In its research on supplier relationship management, APQC has determined that organizations should tailor collaboration with their suppliers to the type of relationship. These relationships occur on a continuum, ranging from purely transactional ones with suppliers of readily available products, to joint venture relationships for essential vendors. Greater collaboration can also help organizations better understand their supply networks and sub-tier suppliers, which can be essential to identifying at-risk suppliers during periods of disruption.

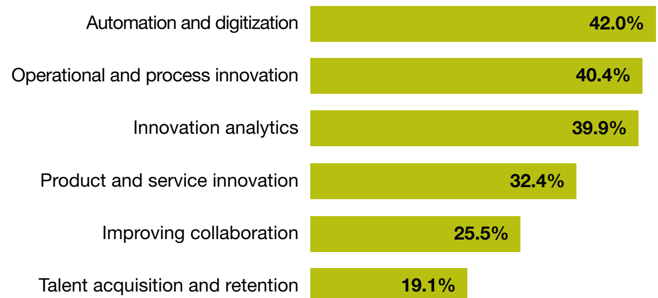
Innovation

Compared with previous APQC surveys, innovation is now an area of greater focus for supply chain organizations. These results, of course, came before the rapid spread of COVID-19. Yet APQC recommends that organizations not sacrifice innovation while addressing more immediate concerns. The actions that an organization takes during an economic crisis, and the long-term planning it engages in, can make a difference long afterward, as shown by companies such as FedEx, Procter & Gamble and General Electric, which all began during times of crisis and thrived afterward.

In its survey, APQC asked respondents to indicate their organizations' priority areas for innovation. As shown in Figure 5, automation and digitization is in the top spot, followed by operational and process innovation and analytics.

FIGURE 5

Organizations' priority areas for innovation



Source: APQC

For the greatest long-term benefit, APQC recommends that organizations focus on operational and process innovation. They can find new ways of working or even new business models to help them be sustainable through the current economic uncertainty and beyond. This can be done as part of other initiatives for supply chain process improvement, such as the further development of supplier relationships and improvement in communication and collaboration.

Moving forward

Overall, the results from APQC's research show that organizations have a balance of priorities focused on cost, service and growth. When asked what overarching goals their organizations were focused on for 2020, 34% indicated decreasing costs, 32% indicated increasing service and 32% indicated increasing market share. In light of the supply chain disruptions and economic uncertainty caused by COVID-19, organizations may be re-evaluating these priorities, especially their growth aspirations, given the uncertainty for the rest of the year.

The events during the first months of 2020 have placed immense pressure on supply chain organizations and their leaders. For several industries, the stakes are high as they work to source materials, produce products needed to fight the pandemic and quickly ship them to the locations that need them most. For other industries, keeping populations supplied with day-to-day necessities has become a challenge. For these reasons, the pandemic has made business leaders more aware of the crucial role supply chain plays and its importance to strategy.

Organizations have an opportunity to build supply chains that are more resilient in the face of unforeseen crises. By continuing to focus on priorities such as automation and digitization, process standardization, and process innovation, they can not only improve their internal efficiency but also provide benefit to the countless others who rely on strong supply chains for daily needs and critical supplies.

About APQC

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

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Procurement at the forefront

By Yves Thill, Elouise Epstein and Sonali Agarwal

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Anyone who has ever participated in a quarterly earnings call or a board meeting knows that company performance (and by extension, CEO performance) is ultimately measured along two dimensions: 1) financial results and, 2) progress against strategic objectives. To be immediately relevant to CEOs, procurement functions must report their performance in terms that tie directly to those metrics.

Few currently do. As a result, CEOs often lack clear understanding of procurement's potential contributions beyond reducing the company's external spending—which most CEOs view as the main CPO metric. This relentless focus on costs is now being severely tested as the COVID-19 pandemic reveals that many supply chains designed to minimize costs were ill-prepared to manage the volatility and supply risk in these unprecedented times. Only by making a rock solid, CEO-relevant business case can procurement garner the CEO attention and investments it needs to be ready for future crises and fulfill its true value-adding potential.

It can be done. We have the honor of working with highly capable CPOs who serve on the top executive teams at respected companies. One such CPO has led procurement to a documented record of sustained cost reduction. But under this CPO's leadership, the function pursues far more extensive ambitions. Procurement is at the forefront of the company's drive for sustained competitive advantage, superior financial results and rapid progress against strategic objectives—and so enjoys unusually strong support from the CEO.

In this company, an end-to-end external spend governance approach interlocks procurement benefits into budgets and avoids leakage. Simultaneously, procurement is a hub for innovation, creating exclusive arrangements with ecosystem partners to take advantage of new technology, improve the bottom line and enable sustainability—one of the company's strategic pillars. It has innovated new economic renumeration for, and sustainable uses of, byproducts, rather than simply negotiating a cheap price for disposal. In sum, this procurement function delivers value that goes far beyond pure deal-making by embracing new approaches to the supply market, actively advancing the company's sustainability agenda and pursuing radical process engineering.

The value of benchmarks

In the typical situation, CEOs may also want to know how well procurement is performing compared with the competition. For many procurement organizations, this need is fulfilled by participating in the Assessment of Excellence in Procurement Study (AEP), a global study of procurement best practices and benchmarks launched by Kearney in 1992 and conducted every two years. The first several sections of the research instrument probe the procurement organization's current practices across a range of variables, including:

- procurement strategy;
- organizational alignment;
- sourcing and category management;
- supplier relationship management;

- operating process management;
- digital and technology; and
- talent management.

One of the most useful outputs is the performance metric, Return on Supply Chain Assets (ROSMA), which is calculated by Kearney in conjunction with the Chartered Institute of Procurement & Supply and the Institute for Supply Management.

Simply stated, the ROSMA calculation is the financial results delivered by the procurement organization divided by invested supply management assets. ROSMA captures specific results of activities to create clear financial value such as retained year-on-year hard savings, improved working capital conditions and improved margins or profitable growth from supplier innovation. Those hard-dollar results link directly to widely used measures of profitability, such as EPS or EBITDA. In sum, ROSMA is the kind of concise yet comprehensive metric CEOs and CFOs find most relevant and valuable—which goes a long way toward giving CEOs confidence that they are getting value for their investments in procurement.

The 2019 AEP benchmarking set includes procurement executives from 153 companies in a broad range of industries—process industries, consumer and retail, discrete manufacturing, services—spanning the Americas, Europe, the Middle East and Asia Pacific. As illustrated in Figure 1, there is a sustained and significant correlation between high ratings in the procurement practices part of the survey and high ROSMA scores.

In fact, top quartile performers achieve ROSMA scores that are two to three times higher than those in the two middle quartiles, and 10 times higher than procurement organizations in the bottom quartile—which are, at best, just breaking even.

Eleven procurement organizations in the AEP 2019 benchmarking set of 150 stand out as the best of the best, based on their high ROSMA scores. These clear leaders share certain traits in common. They are as follows.

Strategically relevant. Procurement executives in leader organizations see themselves as strategic enterprise business partners. Eighty percent of leaders focus more than 70%of their procurement team on strategic activities. Just 17% of the rest of the AEP sample do the same.

Proactive and innovative. Not surprisingly, leading procurement functions are in the forefront of applying advanced technologies. Nearly all in the top group use advanced analytics in sourcing. And 70% of the leaders have formal supplier innovation processes and targets.

Visible and in control. All of the leader organizations report having visibility into at least 80% of their direct and indirect spending, and half of the leaders report having at least a 95% spend visibility. Just 16% of all others have a comparable visibility level. Leading procurement organizations also consistently report that their comprehensive analytics effectively allow for a complete understanding of their cost drivers. Other companies, by contrast, find it hard to collect this necessary data and analyze it to identify complexity reduction opportunities.

Strategic talent management. Leading procurement organizations tend to have a more strategic approach to talent management, and place greater emphasis on creating high-performing teams. Approximately 80% of the leaders say they have proactive internal and external recruiting strategies in place. And all leaders—as opposed to only one in three other companies—have formal mentoring processes.

Broadly impactful. Leading organizations are two and a half times more likely than the rest of our sample to deliver high measured impact on working capital reduction, operating efficiencies and supply risk. They are four times more likely to deliver high impact quantity reduction (Figure 2).

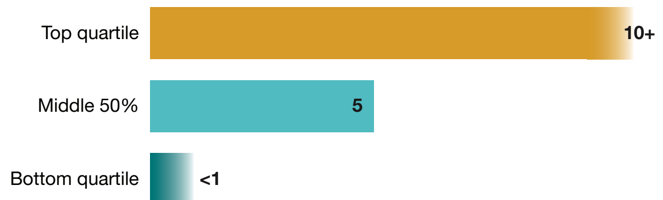
From transactional to disruptive

The striking disparities in approach and performance revealed by the AEP are clearly visible in the world at

FIGURE 1

Return on supply management assets (ROSMA) scores by quartile, 2011-2019

Leaders get a 2-3X higher Return on Supply Management Assets (ROSMA)



Note: Return on Supply Management Assets (ROSMA) is calculated as the financial results achieved divided by the supply management operating costs.

Sources: 2011-2019 ROSMA database; Kearney analysis

large. Most procurement organizations are struggling to keep their internal customers satisfied. In fact, many are viewed by both executive and individual business stakeholders as more of a barrier than a benefit. As consumers, C-suite executives and business unit leaders are deeply familiar with online platforms such as Amazon, where buying is simple and fast. Yet, at work, these same consumers frequently face complex, opaque purchasing processes. An array of business stakeholders is clamoring for change. As a result, more than a few openly question the value of procurement.

Are procurement leaders heeding the alarms? In far too many cases, it seems they are not. Their organizations are still mired in the day-to-day busywork of common desktop activities such as negotiating savings, managing risk, ensuring legal compliance, processing transactions and managing categories. There is nothing inherently wrong with these activities. The problem is that they have often come to define the procurement discipline, when they are really just tools in a larger toolbox.

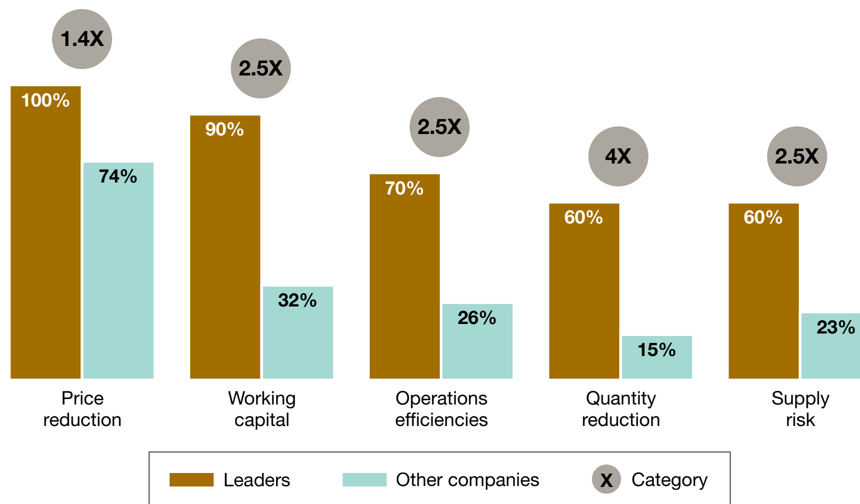
In contrast, a few CPOs are actively leading their organizations beyond procurement's traditional transactional role toward a much more disruptive mindset. They work collaboratively with business units—not just to reduce basic costs, but also to evaluate trends and identify new drivers of value. As a participant at our CPO Roundtable explained, "CPOs get fired for not delivering high-impact cost reduction and promoted if they also deliver strategic value that goes beyond cost reduction." Toward that end, disruptive procurement organizations have multi-year, robust collaborative processes with strategic suppliers for innovation and risk management. They proactively ensure the company has the right number of suppliers with the right capabilities. And they assess supply risk and deploy systematic risk management strategies.

All procurement executives, especially those entering the leadership ranks, have the opportunity to embrace this challenge. They must show stakeholders that they understand internal business requirements. And they must commit to making more clearly relevant, measured and benchmarked contributions to company success. In short, they must lead procurement to the forefront of the company's drive for sustained competitive advantage, superior financial results and rapid progress against strategic objectives.

FIGURE 2

Percentage of respondents reporting that procurement had a high impact on each dimension of value

Leaders get a broad array of value (% responding "high impact")



Sources: 2019 AEP; Kearney analysis

COVID-19 will expand CEO expectations

In a very immediate sense, the coronavirus pandemic has thrust all procurement organizations to the forefront, as companies have scrambled to cope with unprecedented supply risks. One lasting result, we anticipate, will be an expansion of CEO expectations of procurement beyond the past focus on cost competitiveness toward increased demands for risk competitiveness. The full range of strengths demonstrated by leading organizations in the AEP (strategic focus, highly impactful organization, twice the average return) will be even more crucial in the difficult days ahead.

[1] *There is no charge for participating in the AEP survey, which takes about two hours to complete, and each participating procurement organization receives a customized benchmark report, including recommended areas on which to focus.*

A SPECIAL SUPPLEMENT TO:
SUPPLYCHAIN MANAGEMENT REVIEW

TOP 50 TRUCKING
EXCEPTIONAL EXECUTION WINS THE DAY

Operational excellence and management vision continue to drive the Top 50 trucking companies to better serve shippers and the nation.

BY **JOHN D. SCHULZ**, CONTRIBUTING EDITOR

In the trucking world it's called "blocking and tackling," or executing the basics of the business as well as possible at all times and in all conditions. While this sounds easy in theory, it's extremely difficult in real-world conditions.

Truckers consistently face peaks and valleys in demand, equipment, driver availability, rules and regulations and thousands of other small details—the reason that hundreds of trucking companies have ceased operations since economic deregulation in 1980.

Sister magazine, *Logistics Management*'s (*LM*) annual listing of the Top 25 less-than-truckload (LTL) and Top 25 truckload (TL) carriers are the exceptions. In fact, our Top 50 is an annual compilation of the carriers with the top management, best vision, continued operational excellence and, perhaps most importantly, the best blocking and tackling on the front lines of execution.

"I pay attention to the big guys, and if somebody comes out with a better mousetrap that we don't have, we copy it," says Jim Gattoni, Landstar's president and CEO. Landstar's truckload revenue for 2019 hit $2.057 billion, which would rank 5th among the top TL carriers. "But mostly everybody is building on the same tools, whether it's management, strategy or

2019 TOP 25 LESS-THAN-TRUCKLOAD CARRIERS: 2018 REVENUES
(Including fuel surcharges)

Rank	Carrier name	2018 Revenue ($ million)	2019 Revenue ($ million)	YoY % Change 18-19
1	FedEx Freight	$7,352	$7,454	1.4%
2	Old Dominion Freight Line	$3,983	$4,055	1.8%
3	XPO Logistics	$3,830	$3,841	0.3%
4	YRC Freight	$3,153	$3,049	-3.3%
5	Estes Express Lines	$2,761	$2,818	2.1%
6	UPS Freight	$2,706	$2,679	-1.0%
7	ABF Freight System	$2,124	$2,094	-1.4%
8	Saia Motor Freight Line	$1,654	$1,787	8.0%
9	R+L Carriers	$1,692	$1,718	1.5%
10	Southeastern Freight Lines	$1,237	$1,242	0.4%
11	Holland	$1,178	$1,084	-7.9%
12	Averitt Express	$891	$873	-2.0%
13	Central Transport International	$825	$856	3.9%
14	Forward Air	$748	$808	8.0%
15	Dayton Freight Lines	$659	$679	3.0%
16	Pitt Ohio Transportation Group	$633	$670	5.9%
17	AAA Cooper Transportation	$606	$612	0.9%
18	Roadrunner Transportation	$452	$433	-4.3%
19	Reddaway	$424	$421	-0.8%
20	A. Duie Pyle	$351	$386	9.9%
21	New Penn Motor Express	$293	$278	-5.3%
22	Daylight Transport	$264	$262	-0.8%
23	Central Freight Lines	$248	$232	-6.5%
24	Oak Harbor Freight Lines	$226	$230	1.6%
25	Ward Trucking Corporation	$189	$190	0.3%
TOTAL TOP 25 LTL CARRIERS		**$38,478**	**$38,750**	**0.7%**
ALL OTHER CARRIERS		**$4,158**	**$3,806**	**-8.5%**
TOTAL LTL MARKET		**$42,636**	**$42,556**	**-0.2%**

Note: Revenue for LTL operations only, unless otherwise indicated and includes Canadian operations
Source: Company reports and SJ Consulting Group estimates
Prepared by SJ Consulting Group, Inc.

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2019 TOP 25 TRUCKLOAD CARRIERS: 2018 REVENUES

(Including fuel surcharges)

Rank	Carrier name	2018 Revenue ($ million)	2019 Revenue ($ million)	YoY % Change
1	Knight-Swift Transportation	$4,290	$3,953	-7.9%
2	J.B. Hunt Transport Services	$2,581	$3,084	19.5%
3	Schneider National	$2,675	$2,397	-10.4%
4	Prime	$1,937	$2,107	8.8%
5	Landstar System	$2,243	$2,057	-8.3%
6	Werner Enterprises	$1,853	$1,887	1.8%
7	U.S. Xpress Enterprises	$1,562	$1,521	-2.6%
8	CRST International	$1,583	$1,469	-7.2%
9	Daseke	$1,345	$1,421	5.6%
10	Ryder Systems	$1,094	$1,163	6.3%
11	Crete Carrier Corp.	$1,151	$1,151	0.1%
12	Penske Logistics	$919	$1,110	20.8%
13	CR England	$1,003	$995	-0.8%
14	Ruan Transportation Management Services	$813	$885	8.9%
15	TFI International	$811	$759	-6.4%
16	PS Logistics	$654	$744	13.8%
17	Western Express	$695	$684	-1.7%
18	Covenant Transportation Group	$706	$677	-4.1%
19	Stevens Transport	$667	$646	-3.1%
20	Marten Transport	$599	$644	7.5%
21	Anderson Trucking Service	$674	$636	-5.6%
22	Cardinal Logistics	$645	$622	-3.6%
23	NFI Industries	$572	$604	5.6%
24	Heartland Express	$611	$597	-2.3%
25	Mercer Transportation	$607	$541	-10.9%
TOTAL TOP 25 TRUCKLOAD CARRIERS		$32,289	$32,352	0.2%

Revenues primarily for truckload operations and may include less than ten percent for non-truckload services
Source: Company Reports and SJ Consulting Group estimates
Prepared by SJ Consulting Group, Inc.

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operations. So, I don't see them doing anything that we're not doing or planning on doing."

Analysts agree. They say that while trucking appears to be a simple business—pick it up, deliver, don't break it, get paid—it's amazing how few carriers actually perform those basics consistently well over time to earn ranking in the *LM* Top 50.

"While it's not rocket science, there are essential basics that some carriers often lose sight of," says Satish Jindel, principal of trucking analyst firm SJ Consulting. Indeed, mastering those basics is essential because of trucking's high fixed costs. Equipment and labor account for about 70% of a typical trucking company's costs—and that's even a higher percentage for LTL carriers because of their hub-and-spoke terminal networks.

"With such a high level of fixed costs, you must have a very well-oiled operational machine," explains Jindel. "Old Dominion, Saia, XPO, for example, all get full productivity from their people. That's the No. 1 element."

The other key is correctly pricing for freight services—including accessorials such as inside deliveries to retail stores, specialized equipment and weekend or night services. The best carriers manage their freight volumes to their equipment and personnel and get paid for doing it.

That explains why a carrier such as Old Dominion Freight Line can routinely post operating ratios in the low 80s—and once in awhile even in the 70s—while enjoying double-digit revenue growth rates at the same time.

So what else makes the Top 50 stand out from the rest? Sometimes it's merely performing the basics better than their competition. Other times, it's precisely managing capacity to

take advantage of the best lanes of freight in the marketplace. Or it can be that precisely blending operational excellence with a stable and visionary executive team. Let's look at what's keeping the top carriers on top.

How to stay on top?

According to Darren Hawkins, president and CEO of YRC Worldwide, parent of the 4th- and 7th-largest LTL carriers, says that the best carriers are the ones who "obsess" over customer service in delivering on-time nearly all the time.

Other top carrier executives say that rather than fighting headwinds in the industry, it's better to go with the flow and simply deliver based on the ever-shifting customer needs. "Rather than push back against changes occurring in the modern supply chain, we choose to evolve," says Phil Pierce, Averitt's executive vice president of sales and marketing. Averitt ranks 12th in this year's LTL rankings by revenue.

As examples, Pierce points to two of Averitt's newest service offerings—Averitt Distribution and Fulfillment (ADF) and Averitt Final-Mile to residential customers seeking a last-mile freight solution. "Consider the growth of online sales and the increasing demand for quicker deliveries that have moved into business-to-business markets," he says.

According to Pierce, the ADF infrastructure consists of numerous shared-space distribution centers, a network that has grown to more than 1.2 million square-feet of freight staging and inventory management space. Averitt positioned the service in key markets, such as Nashville, Atlanta and Austin where those facilities enabled it to increase the speed-to-market of customers' products.

"Additionally, we can integrate a wide variety of our services, including LTL, intermodal and drayage to provide our shippers a complete supply chain solution," adds Pierce.

But it's still equipment utilization that drives profits. The best carriers live by the mantra of how to best utilize their two most expensive assets—drivers and equipment. YRC's Hawkins calls it the "biggest opportunity we have" to drive better productivity and profits.

"Drivers and equipment are very expensive and we have to keep our most expensive assets freed up and productive," Hawkins said. "That requires good, clear lines of communication. We prioritize freeing up our equipment and drivers. We need to keep both moving to cover their costs."

The carrier with the drivers wins

In an era of historically low unemployment, the decades-old driver shortage has only worsened as qualified drivers have become scarcer and more expensive than ever. The American Trucking Associations (ATA) estimates the industry is short some 60,000 drivers right now—and that total could top 100,000 in the next few years.

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For decades, the biggest churn was in the truckload sector where driver turnover can exceed 100% at even some large companies. The unionized sector—which mainly consists of UPS freight and parcel, YRC long-haul and regional and ABF Freight—was largely immune from the shortage.

However, now even unionized companies—even though their turnover rates are in the single digits—are being hit by driver shortages as the work force ages and retire. Industry leaders say demographics are working against the industry, even in the unionized sector. "The available pool is not as deep as it once was," says YRC's Hawkins. "We offer a good pay package and the LTL lifestyle is good and that keeps our turnover rates in the single digits."

But even YRC and other companies have had to expand their recruiting base. YRC actively recruits military veterans who now comprise 14% of its work force while women drivers account for another 6%.

New Jersey-based NFI says that it has grown its female driver population by more than 36% in one year by offering higher pay and benefits. NFI adds that it is "committed to diversity by building an industry-leading training program that gives female drivers the opportunity to train and mentor women who have just graduated from truck driving school."

Averitt's Pierce said the carrier is committed to getting drivers home "every week" both in its LTL and truckload divisions. Indeed, maintaining a fresh fleet with measures such as this has been a major factor that has allowed the top carriers to overcome the challenges of fuel, regulations and retaining drivers.

The technology and ergonomic designs found in modern tractors and trailers provide improved fuel efficiency, increased safety performance and comfort for drivers. That has allowed some large carriers to keep the average age of their fleet to less than three years old.

And like many carriers, Averitt is continuously seeking ways to improve the driver experience. It recently implemented a *per diem* program in addition to its layover, detention and minimum mile pay systems. According to Pierce, the carrier has also focused on enhancing many of their service centers to include "driver support centers." Among other amenities, these facilities feature lounge areas, Internet access, showers, laundry machines and gym equipment.

"Our goal is to provide as much comfort to our drivers as we possibly can," Pierce said.

New truck, trailer sales down—bad news for shippers

Class 8 sales figures are always a double-edged economic sword. More trucks mean more capacity—and usually lower freight rates.

Even though carriers sharply reduced their buying of new trucks from near record rates—Class 8 truck sales totaled 180,951 last year compared to 490,100 in the record year of 2018—they say they're for replacement, and not fleet expansion.

"But guess what? Those old trucks traded in are being bought by other trucking companies and owner-operators and they're still in use," says trucking analyst Satish Jindel.

There are signs that new Class 8 truck and trailer sales are moderating. January Class 8 sales fell 22.5% year over year to 15,645, and the coincided with a 43% year-over-year drop in trailer orders to 15,000, down from 26,169 in January 2019, according to figures compiled by the research firm ACT.

One lure of the newest Class 8 models for the top carriers is the wide range of newer safety technologies, such as collision-avoidance systems and forward-facing event recorders to help protect drivers and the general public.

"Our team is continuously researching and testing new technologies that will help us operate more efficiently and safely even when there is no regulatory pressure to do so," says Phil Pierce, executive vice president of sales and marketing at Averitt Express. "People are our number one asset."

Newer equipment helps in driver recruitment and retention. So, even though there's a dip in Class 8 sales for now, shippers should look for an uptick in overall new truck sales to help in their hunt for capacity as the shipping season tightens.

—John D. Schulz, contributing editor

Capacity and rates?

Until the coronavirus scare hit in the first quarter, Top 50 carrier executives were rather optimistic about the 2020 rate picture—but uncertainty is now in the air.

Susquehanna Financial Group recently issued a forecast that was mostly bad news for shippers. It says trucking rates would have a "melt-up"—in other words, an irrational increase. The epidemic tempered that a bit, but the report by analyst Bascome Majors was enough for the company to raise ratings on Landstar and Werner, two TL giants in the top 10 of *LM* rankings.

After falling for 16 straight months, spot TL rates have evened out and even started to rise in the first quarter,

according to DAT, a research firm. "Spring could be coming early to truckload freight," DAT reported in the first quarter. "Load counts are holding steady and load-to-truck ratios are showing signs of life, for vans, reefers and flatbeds. Rates are even starting to trend up, especially in the eastern half of the country."

Overall TL capacity is forecast to shrink 1% this year compared to a 4% increase in both 2018 and 2019. "Seasonal-plus patterns are returning to volatile real-time rates," Majors added.

In closing

With shippers' supply chains and inventories slowly adjusting due to the coronavirus, trucking executives say 2020 should be a better year than 2019, but not as good as 2018 when nearly every

trucking company was profitable.

However, nobody is saying that with any great deal of certainty due to the coronavirus disruptions to worldwide supply chains. "It's not 2018 or 2019. But capacity was a little more balanced at the beginning of the year than it was at the end of last year," adds Landstar CEO Gattoni.

That evenness in demand levels is somewhat offset by what some executives say are relentless increases in their internal costs. However, operational costs for truckers are rising, often by double-digit percentages. Insurance costs, stung by what trucking executives call "nuclear settlements" by juries in wrongful death accident cases, are doubling for some smaller carriers.

The ATA's research arm says rising insurance rates are contributing to an overall 7% rise in trucking costs. "We have to offset that every year, and that factors in our rate increases," adds YRC's Hawkins.

John D. Schulz is a contributing editor to Supply Chain Management Review

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MODEX IN REVIEW

With more than 900 exhibitors, 150 informational seminars, and 370,000 square feet of expo space, MODEX 2020 focused on best-in-class solutions for manufacturing and supply chain operations. Show sponsor MHI is looking ahead to a record-breaking ProMat 2021—the industry's premier supply chain event. ProMat will be held at McCormick Place in Chicago, April 12-15, 2021.

MHS launches new software, predictive maintenance solutions for warehouses

MHS launched a new warehouse software solution built to address the challenges distribution and fulfillment centers face as a result of e-commerce growth. Comprising template-based modules for equipment control, inventory management and order fulfillment functions, MHS Helix works in customized configurations according to each facility's unique requirements.

"With DCs becoming increasingly complex, getting all the processes aligned using traditional warehouse software systems can result in runaway complexity, with several layers of software, redundancy and one-off customizations," said Tab Fischbach, senior vice president of business development for distribution and fulfillment. "Our approach with Helix is to keep things simple, with ready-made modules that allow businesses to scale with new functionality while maintaining a single, lean platform."

The company also launched MHS Insights, a condition-based maintenance solution that monitors assets through IoT sensors and system data to provide timely maintenance recommendations and strategic health assessments.

Tab Fischbach, senior VP of business development for distribution and fulfillment at MHS, explains how to keep modernization simple.

RightHand Robotics showcases RightPick2

Yaro Tenzer, CEO and co-founder of RightHand Robotics, explains how the RightPick2 learns successful picking technique.

RightHand Robotics showed its RightPick2 autonomous robotic piece-picking platform, which handles the picking and placing of individual items as part of a range of warehouse workflows and processes. RightPick2 combines new skills based on RightPick.AI, the AI-enabled vision and motion control software with deep learning.

The system can pick and place thousands of SKUs,

fulfilling orders at high speeds while playing an integral role in consistent order management. "RightPick2 sets a new standard for speed and dependability," said Leif Jentoft, co-founder of RightHand Robotics.

As a materials handling automation company, RightHand Robotics is streamlining order fulfillment with flexible, data-driven picking solutions, bringing dependability and scalability to fast growing retail markets.

"Being able to reliably pick a wide range of items at a high rate helps distribution and fulfillment centers improve overall customer experience," Jentoft added, making them more competitive in the global marketplace.

Vanderlande shows scalable solutions

Vanderlande demonstrated Evolutions, the next generation of scalable solutions built to meet the challenges of today's warehouses and DCs. These modular solutions help solve demanding customer expectations such as speed, accuracy and flexibility. The components of Evolutions—FASTPICK, AIRPICK, and STOREPICK—were developed specifically for the e-commerce, fashion and food-retail markets.

"At Modex, attendees can see the latest designs and solutions that we're presenting to the marketplace," said Jerry Johnson, business development manager at Vanderlande, "and get a feel for the speed, accuracy, flexibility that these solutions drive throughout the entire order and delivery process."

Working with technology, software and lifecycle services, Vanderlande is evolving with its customers to create a next generation of flexible and scalable solutions. The company's offerings include the Adapto shuttle, pocket sorters, goods-on-hanger solutions, and automated case picking technology.

FastFetch unveils carton selection system

FastFetch presented its latest patent-pending solution, the IntelliPack Shipping Cost Optimization System. Using artificial intelligence, the system can determine a set of more than 40 carton sizes (to be used in packing) by examining historical order data.

Using the dimensions of items in an order, the system also decreases shipping costs, packing labor, corrugated material and dunnage, as it selects the carton sizes best suited to pack items—with minimal wasted space—from the set of more than 40.

After scanning an order bar code before or after picking, the system then quickly computes (in less than a second) the best carton size for the order items and indicates that carton, using a segment of LED lights.

"As a result, customers' typical ROI payback period is less than 3 months," said Garry Harper, VP, sales and marketing, FastFetch.

Frazier demonstrates three new structural designs

Frazier Industrial demonstrated three new wire screen designs. Available in reverse, standard and structural pallet support options, the new products use an internal flare "tuck-in" style, as opposed to the industry's current external flare style.

According to EVP Domenick Iellimo, the products help solve two major issues—warping wire beds and jagged pieces of wire—commonly associated with the industry's current design.

"The biggest warehousing challenges faced with the current design are wires bending under the weight of products and being torn apart by fork trucks when loading," said Iellimo.

The new "tuck-in" design eliminates these risks, provides greater safety across the warehouse operation, and is more cost effective than other options. It provides value in any warehouse setting and is particularly useful in environments that rely on hand-stacking or egress with tunnels as part of their applications.

Domenick Iellimo, EVP

Knapp presents the perfect blend of robotics and AI

Heimo Robosch (left), EVP sales, and Josef Mentzer, CEO Knapp North America.

Knapp discussed its strong business growth over the last year, gave an overview of its latest products, and showed how a partnership with Covariant is helping it create AI-enabled robots for the fulfillment environment.

Knapp's executives gave the audience an update on the OSR Shuttle Evo, of which the company has sold more than 15,000 units since introducing it two years ago. Launched last year, the Pick-It-Easy Evo offers a modular option that can be adapted to any facility.

Knapp's PIE Robot is Cloud integrated and features self-learning capabilities that build and enhance its SKU database. "These features have not been available in the market until today," said Kevin Reader, director of business development and marketing, "and have lifted real world success rates for fully automated order picking from 20% to 95% or more."

Sealed Air exhibits automatic filling and sealing machine

From left: Chris Rempe, VP of marketing, Autobag; Fadi Haddad, product manager, Autobag; and Nick Pacak, regional sales director, Sealed Air, with the Autobag 650 Horizontal Wide Bagging System.

Sealed Air displayed the Autobag 650 Horizontal Wide Bagging System, an automatic filling and sealing machine that can run up to 16-inch wide bags.

Configured ergonomically for left- or right-hand access, the system offers users a large load area for order preparation, along with a highly compressed design that diminishes floor space. In addition, it has a 24-inch conveyor with an open-space design, so users have unlimited access, as well as easy transition, onto other conveyance systems.

Often used with Autobag pre-opened bags-on-a-roll or bags-in-a-box and AutoLabel Thermal Transfer Ribbon, the system also features an adjustable pass-through length of up to 6 inches, leading to high packaging efficiency.

"Simply put, the system is ushering in the next evolution of wide bag packaging," said Chris Rempe, VP of marketing for Autobag.

The Raymond Corp. demonstrates suite of warehouse solutions

Michael Field, president and CEO of The Raymond Corp., highlights the autonomous tuggers, carts, pallet shuttles and analytics solutions that enable granular visibility, enhanced control and repeatable performance.

The Raymond Corporation exhibited a portfolio of intelligent warehouse solutions to help customers determine the best path toward automation. Using telematics and real-time locating systems, the solutions gather valuable operational data and connect directly with entire fleets, assets and workforces.

The optimized warehouse creates more space for product, increases workforce productivity, and leverages lift trucks for the best suitable task. Using Raymond Lean Management (RLM), warehouses can be optimized by standardizing work, tracking KPIs and supporting continuous improvements.

After optimizing, Raymond offers products and solutions that can automate a variety of tasks for greater speed and accuracy. "At Raymond, we believe that continuous optimization is key to getting the most out of an operation," said Michael Field, Raymond's CEO. "As an end-to-end intralogistics solutions provider, Raymond can help customers understand the path toward automation and the processes required to meet their specific needs."

ORBIS showcases sustainable retail supply chain solutions

ORBIS Corp. showed a line of reusable packaging products that help organizations achieve supply chain sustainability. From plastic pallets to totes and bulk containers, these tools help retail supply chains find a better way to transport product to and from warehouses, distribution centers, delivery trucks and retail stores. The reusable packaging provides reliable, efficient solutions for retail supply chains, but it also can be manufactured, used, reused and reprocessed without impacting the solid waste stream.

"Supply chain managers have a lot of responsibilities—from adding automation to streamlining product flow," said Bob Peterson, VP of marketing and product management at ORBIS. "Sustainability is now near the top of their priorities."

ORBIS' sustainable packaging solutions include XpressBulk for bulk merchandising, pallets and totes for use in automation, Pally mobile pallet, small-format pallet with totes, and 40 x 48 HDMX for food and beverage caps and closures.

Bill Ash, ORBIS president, with the XpressBulk delivery system.

Körber and Twinlode announce new strategic partnership

Richard Kooistra, VP of automation for Twinlode, discusses the partnership with Körber.

Körber Supply Chain and Twinlode Automation announced a partnership that will expand their respective capabilities to provide more comprehensive solutions to companies in North America that want to build smarter, more efficient automated warehouse environments.

This partnership brings together the expertise of Körber's software and system integration with Twinlode's building materials handling systems expertise. "Our partnership with Twinlode is an opportunity to support North American customers and transform these complexities with automated facilities into a strategic differentiator," Pieter Feenstra, chief sales officer, automation, at Körber. "Be it more products, suppliers, distribution channels or labor challenges, we assure supply chains are ready to meet consumer expectations now and beyond."

Körber will use its diverse family of solution providers to continue to plan, engineer and deliver complete automated systems to the customers, while Twinlode will be prospecting new customers within the target markets.

Swisslog Logistics unveils new robotic item picking paired with AutoStore

Swisslog Logistics highlighted its new and improved logistics dream team. Known as ItemPiQ, the robotic single item picking solution pairs perfectly with AutoStore and delivers new levels of warehouse productivity. With rapid robotic picking, improved product recognition and multiple gripping modes that adapt to different products and sizes, ItemPiQ makes robotics an option in more places. The system centers around a KUKA six-axis lightweight robot and a vision system with a 3D camera and smart image recognition software.

When integrated with the AutoStore robotic storage and retrieval system, the solution creates a fully automated goods-to-robot system designed to shorten both pick times and ROI. "Picking and packing can account for nearly 50% of all logistics costs in industrial and commercial logistics and DCs," said Markus Schmidt, president, Swisslog Americas. "ItemPiQ helps cut these costs permanently while helping alleviate labor shortages."

Markus Schmidt, president of Swisslog Americas, explained how WES integrates robotic item picking into the flow of an operation while providing exception handling.

Honeywell Intelligrated showcases next-generation DC technology

Matt Wicks, chief robotics solution architect, in front of the robotic truck unloader.

Honeywell Intelligrated showcased forward-thinking innovations in workforce optimization, robotic integration and Industrial Internet of Things (IIoT) connectivity in the distribution and fulfillment space.

The company is demonstrating a variety of solutions that help DCs make the digital transformation necessary to increase reliability, improve utilization and maximize productivity.

The company displayed design simulation and concepting solutions; a robotic unloader; an AS/RS system; goods-to-robot (GTR) picking; order picking workflow automation; and Honeywell Voice, which uses voice-guided workflows that help companies run smarter and better.

On display were "practical solutions for some of the biggest challenges facing DCs today—from addressing limited labor availability to keeping pace with e-commerce expectations," says Pieter Krynauw, president of Honeywell Intelligrated, "all while minimizing costly downtime."

EnerSys battery solutions enable optimal productivity

EnerSys detailed how its systems approach to battery solutions boosts productivity by reducing maintenance and battery charging.

The NexSys battery portfolio, including NexSys PURE and NexSys iON batteries, offer warehouses and DCs varying technologies, enabling a hybrid power approach to materials handling operations. Engineered with the latest generation of proprietary Thin Plate Pure Lead (TPPL) and advanced Lithium-ion (Li-ion) technologies, both batteries are designed to deliver productive, predictable power.

Harold Vanasse of EnerSys points out one of the company's opportunity charging stations.

"EnerSys strives to remain at the forefront of innovation to provide our customers with premium motive power solutions that maximize productivity," said Harold Vanasse, senior director of marketing, Motive Power Americas at EnerSys. "Our suite of advanced NexSys batteries gives operators two dependable choices exclusively tailored to meet and exceed their power demands regardless of the vehicle application. Both battery chemistries can be utilized in different applications in the same facility to achieve an overall lower total cost of ownership."

Optimized for fast- and opportunity-charging, NexSys PURE batteries are available in a range of capacities and configurations. The batteries are also equipped with an integrated Battery Management System (BMS) and a battery monitoring device to track various performance metrics, including discharge current, charge current and State of Charge (SOC).

Vanasse showed how Enersys's opportunity charging stations allow a materials handling vehicle to simply drive over a location on the floor to automatically charge the battery. Such stations, when combined with features like the monitoring dashboard, are examples of the systems approach EnerSys is taking to ensure operations don't waste time or space on battery maintenance.

Interroll unveils products, platforms and solutions

Interroll introduced a new platform-based approach to its conveyor and sortation products.

Boxes are great for automated handling, but polybags confound traditional solutions, according to Steven Leavengood, vice president of sales and service at Interroll Group. Even those who have found workable solutions for handling 6-inch bags now find 12- or 18-inch bags are used for more products to achieve dimensional savings.

"The No. 1 cause of automation downtime is not knowing what needs to be handled, or not designing the solution to handle it," Leavengood said. Crossbelts are a much more forgiving handling technology, he said, making them ideal for applications with bags and returns. However, many crossbelt solutions have a motor in each carrier, meaning 200 control points, electrical connections and opportunities for failure.

The new High-Performance Crossbelt Sorter operates on a mechanical sortation principle. The crossbelt carriers run on aluminum profiles for linear sortation or steel tubes for horizontal sortation and are pulled by a lubricant-free rubber belt instead of drive chain. Once a crossbelt carrier reaches its destination, a pneumatically actuated plate makes contact with a drive wheel underneath the carrier. The motion of the carrier is converted into driving the crossbelt.

"A very rudimentary maintenance team can service this technology, and the simplicity means a 6-month lead time compared to a year or more," he said. "Many customers are not investing just for advantages, but out of necessity, and this allows them to address e-commerce at a faster pace while maintaining high quality."

Interroll introduced a new platform-based approach to its products.

Because no motors and equipment are mounted to the side of the sorter, induction points can be more compact and reconfigurable. The system can support throughput rates of 2,000 to 15,000 units per hour, sorting goods from 0.1 pounds to 77 pounds.

Tompkins Robotics' t-Sort tackles micro-fulfillment

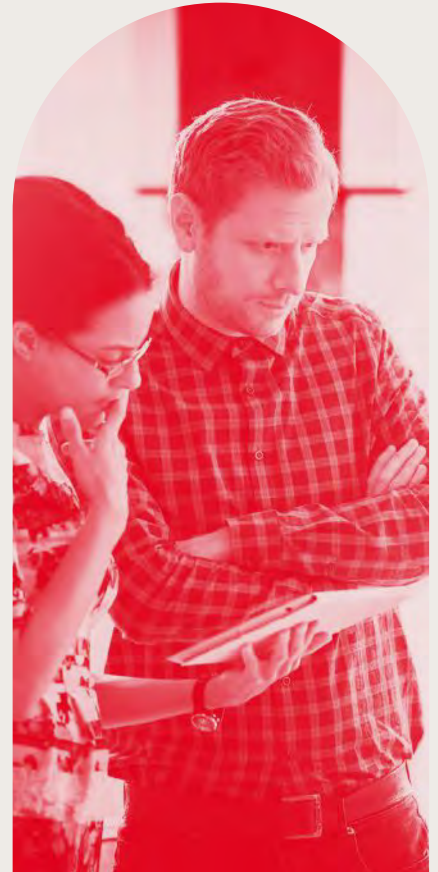
Mike Futch, president of Tompkins Robotics, outlines the variety of options and flexibility of the modular, collapsible T-Sort.

Tompkins Robotics can set up its t-Sort unit and parcel sortation system in a customer facility just as fast as it set it up for Modex.

According to Mike Futch, president of Tompkins Robotics, the system can break down and set up within a single shift, allowing customers with limited space to respond to daily busy periods by wheeling out the platform and loading it with mobile robots. Afterward, a 1,000-square-foot sorter, for example, can be collapsed to about 100 square feet for storage, perhaps in an empty pallet rack bay.

A micro-fulfillment solution could easily sort 2,500 units per hour and larger systems can handle 50,000 per hour. The system can also fit into whatever space is available, whether it's shaped like a U, L or Z. The system serves both outbound and inbound flow, and is capable of sequencing replenishment not just by aisle, but by the front left third of an aisle, for example.

For grocery handling, Tompkins is developing a version of their tilt-tray sorter robot with an underside capable of cleaning the surface of the platform.



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LOGISTICS

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