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PUTTING SUPPLY CHAIN RESILIENCE THEORY INTO PRACTICE

Morris A. Cohen

The Wharton School,
University of Pennsylvania

Shiliang Cui

McDonough School of Business,
Georgetown University

Sebastian Doetsch

WHU—Otto Beisheim School
of Management

Ricardo Ernst

McDonough School of Business,
Georgetown University

Arnd Huchzermeier

WHU—Otto Beisheim
School of Management

Panos Kouvelis

Olin Business School, Washington
University in St. Louis

Hau Lee

Graduate School of Business,
Stanford University

Hirofumi Matsuo

Tokyo International
University

Andy A. Tsay

Leavey School of Business,
Santa Clara University

Morris Cohen et al. find that while managers generally understand the basics of supply chain resilience, putting them to work remains challenging. Drawing on interviews with executives, they describe these challenges and share their recommendations for how to overcome them.

The COVID-19 pandemic might seem like a once-in-a-lifetime event, but it is just the latest incident within the last dozen years to cause a major supply or demand disruption. Other disrupting

events include the financial crisis in 2009, the earthquake in Japan and subsequent nuclear disaster in 2011, the Thailand floods in 2011, and the US-China trade conflict that escalated in 2018. An organization's supply chain

resilience is often a source of competitive advantage, but the scope and magnitude of these recent disruptions have made resilience a matter of survival.

We set out to understand why some firms did well in response to the current crisis (exhibiting resilience), and some did not. A company's agility can be defined by how rapidly and cost-effectively its supply chains can respond to short-term changes in demand or to supply disruptions. In the long term, a disruption could result in a new normal with lasting implications. A company's resilience is thus defined by how well its supply chains can proactively adapt to this new normal. Put another way, resilience indicates a company's ability to adapt to structural changes by modifying its supply chains, products, and technologies strategies. By creating resilient supply chains, companies can diminish the risks caused by future disruptions.

Proactive resilience strategies can benefit companies in many ways, including time to recovery (TTR), direct costs (e.g., added expenses, lost revenue), customer service level (e.g. availability, delay, product quality, responsiveness to customer demands), brand impact (based on market share, profit margin, customer loyalty), and the required managerial effort (time and energy of top-level management).

Many supply chain experts and authors reacted to the recent COVID-19 pandemic by writing articles about how companies are using (or considering using) proactive supply chain strategies to improve their resilience. In Gartner's May 2020 report "Weathering the Storm: Supply Chain Resilience in an Age of Disruption," Gartner used the responses from 260 senior supply chain managers to deduce six strategies for achieving supply chain resilience. While these strategies have evolved over

time, the general topic is not new. In fact, the set of themes presented in Gartner's article, as well as others, suggests that the basic roadmap to supply chain resilience is well-established and generally understood by managers. We might expect that most companies have thus already built resilient supply chains. Yet companies' supply chains still vary considerably in their resilience.^{1,2,3}

We set out to understand what prevents companies from creating resilient supply chains, even when the concept is familiar and clearly defined. During the COVID-19 pandemic, we interviewed several senior supply chain executives and found that their experiences and perspectives could help other companies increase their supply chain resilience.

While an organization's supply chain resilience is often a source of competitive advantage, the scope and magnitude of recent disruptions have made resilience a matter of survival.

We learned that companies must have short-term, reactive, and agile responses to quickly stop the bleeding during a severe disruption. We also learned how companies have developed proactive strategies to build supply chain resilience by adopting multiple elements (Figure 1). The reported supply chain activities are divided into two categories: enablers and resilience strategies.

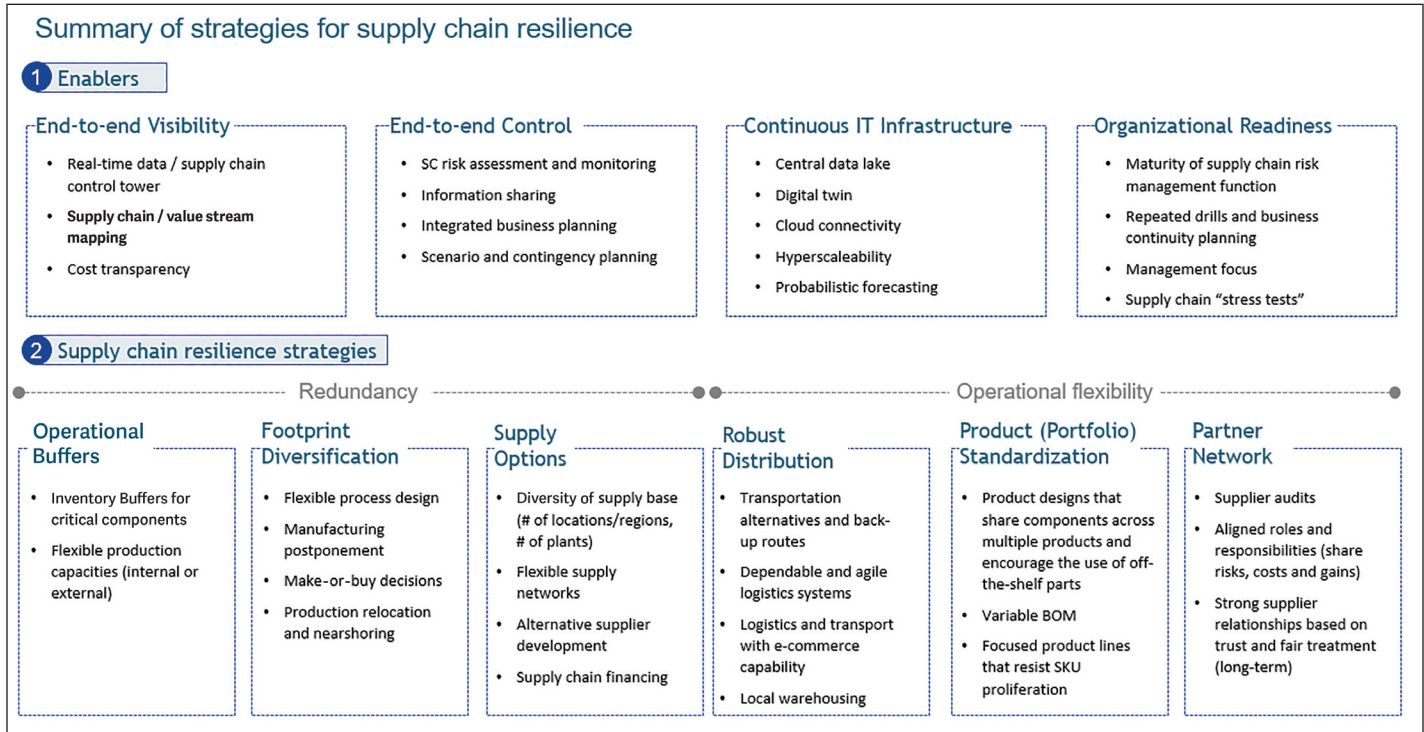
The resilience strategies include policies that increase redundancy in a supply chain, such as investment in operational buffers,

footprint diversification, and supply options. They also include decisions that enhance a company's ability to mitigate risks, such as robust distribution, product standardization, and the strengthening of partner networks.

The first three clusters of enabler activities in Figure 1 are generally understood to represent supply chain management's best practices during normal times. The fourth cluster lists the actions a company should make to prepare for situations that require resilience. These actions will help managers make informed decisions on resilience and should be seen as prerequisites for implementing the strategy elements. For example, a manufacturing postponement strategy requires end-to-end control (information sharing, integrated business planning) and visibility (value stream mapping) to be effective.

We interviewed fourteen supply chain executives from twelve companies with the goal of identifying both the most common challenges in achieving supply chain resilience and the best ways to overcome these challenges. We chose the companies by considering each one's global supply chain footprint and leading position in its respective industry. We also aimed for companies that represented a diverse mix of industries, headquarter (HQ) regions, and operating models, including four companies that made Gartner Supply Chain's Top 25 in 2020. (See Figure 2 for more information regarding the companies included in the sample.) Our interviews focused on the following themes: How did your company respond to the COVID-19 pandemic? What are the key elements of your company's resilience strategy? What tools and methods were used to develop the strategy? What are the key takeaways going forward?

Figure 1: Integrated supply chain resilience management framework



Developing a supply chain resilience strategy

We found that designing a resilient supply chain can be viewed as a two-stage process. The first step is to select the right set of strategies from the elements noted in Figure 1. It goes without saying that no company can implement

all these resilience strategies due to cost, limited resources, and the potential for conflicts among the elements. Before choosing the appropriate strategy elements, therefore, managers should consider their company's specific tradeoffs and constraints. Defining the right strategy for your company requires

weighing the pros and cons of each resilience strategy element and then deciding whether the element should be applied company-wide or differentially to the various product groups/segments. Moreover, there is a question of sequence prioritization and outlining a timeline for the strategy's implementation.

After making these decisions, the second step is to define how best to execute the strategy by considering all the limitations, boundary conditions, and available resources. Companies may find that they need to accept an alternate supply chain setup if their first choice turns out to be too costly or impractical. The process

Figure 2: Overview of interviewed companies

No.	Industry	Revenue (bn€)	Employees	HQ Region
1	Chemistry/Agriculture	20,0	34.000	Europe
2	Food	2,5	2.000	Asia
3	High tech	2,0	8.000	America
4	High tech	46,0	76.000	America
5	Consumer products	14,0	34.000	America
6	Industrial goods	16,5	88.000	America
7	Chemistry/ Consumer products	20,0	53.000	Europe
8	High tech	26,0	60.000	America
9	High tech	8,0	41.000	Europe
10	Apparel	10,0	17.000	Asia
11	Apparel	9,0	77.000	America
12	Consumer products	52,0	150.000	Europe
Ø		19,0	53.000	

Defining the right strategy requires companies to weigh the pros and cons of each resilience strategy element.

of implementing a resilience strategy can be improved by collaborating with supply chain partners such as core suppliers or logistics providers.

Based on the interviews we conducted, companies face six common challenges when implementing resilience strategies. These challenges can complicate or even hinder the attempt to achieve resiliency.

1. Heterogeneity of supply chains.

Generally, companies with a certain size and scope cannot use a one-size-fits-all supply chain design. The supply chain of such a company, rather, should be a portfolio of different supply chain structures. We observed this supply chain diversity even at the level of a single business unit with supply chains that are specific to individual products. We refer to this phenomenon as the heterogeneity of supply chains. Some of the managers we interviewed also confirmed that current surveys on this topic often use the entire company as their unit of analysis. Given the complexities and the diversity of attributes in the supply chains of a company, an individual manager may have difficulty in providing meaningful answers in such surveys.

The heterogeneity of supply chains makes the implementation of resilience strategies more complicated because a company's supply chain strategies need to account for a plethora of interdependences and interactions. Decisions need to be made on a case-by-case basis. Many of the interviewed companies have adopted different designs for different elements of their supply chain strategy but converge with respect to others. This is especially true for logistics and distribution. Some

companies recognized that certain products need a different strategy altogether, but the low volume of those products makes it hard to justify. So, even if you know what the right supply chain for a given product should be, you may not always be able to achieve it. We also observed that when some companies had a portfolio of supply chain strategies, they still applied a unified approach to specific functions. Coordinating multiple resilience strategies within a firm can thus be a challenge because a specific resilience strategy might be beneficial for one product but not for the whole company. And some product types may not need a resilience strategy at all.

In the context of multi-firm supply chains, a key question is how to allocate the costs and benefits of resilience.

When a company produces a diverse set of products, the advantage of using heterogeneous supply chains is that they tailor the strength and cost of a specific supply chain to the needs of particular products. But, this might require a larger fixed investment and increase a company's overhead costs. On the other hand, if the heterogeneous supply chains have been set up to be flexible, for example regarding capacity or production capabilities for multiple product groups, then different supply chains could be leveraged to support the needs of different product segments. Heterogeneous supply chains thus can offer a

significant competitive advantage when they are designed correctly.

2. Fragmentation of the decision-making architecture.

Decades of globalization and supply chain optimization have led many companies to outsource some, or all, of their manufacturing. This fragmentation of the supply chain architecture leads to several issues, including reduced visibility, longer lead times, the need for coordination among multiple managers, and the potential for misconceptions, conflicts of interest, and misinformation.

In the context of such multi-firm supply chains, a key question is how to weigh the costs and benefits of resilience. Manufacturers sometimes offer incentives to motivate their key suppliers to invest in new geographies or capabilities. It can be a delicate balancing act to enhance supply chain flexibility by spreading spending across more suppliers without discouraging the individual suppliers from making the investments needed to improve performance. Failing to integrate supply chain management across business units and company boundaries during a disruption can result in an every-one-for-himself mentality and thus at best a local rather than global optimal solution.

During the COVID-19 pandemic, we observed that some of the interviewed firms strongly relied on their cooperative relationships with suppliers and/or customers. These companies had sound visibility and risk sharing schemes already in place. Fragmentation, in these cases, enabled decentralized execution, which allowed for quick responses to adjust orders

and production plans. Without such extended visibility and cooperative relationships, however, fragmentation would impede resilience.

3. Accentuated efficiency and resilience trade-offs.

According to the interviewed senior managers, cost efficiency will remain the top priority when designing future supply chains. This is contrary to recent predictions. Even though calls for resilience are getting louder, firms must still consider the cost, speed, flexibility, and risk mitigation for both short-term dynamic resource allocation decisions and long-term resource investments. Companies ultimately will have to prioritize these factors according to their own product and market characteristics, which may also change over time.

We observed that companies often struggle with defining and identifying all the necessary costs of making informed trade-off decisions. For example, the total landed cost, which is based on allocating all fixed and variable costs for making a product available for a specific market, enables benchmarking of product profitability. However, it often does not include shortage costs and other intangibles such as the risk to a company's reputation (which is hard to quantify). Ultimately, making the right trade-offs will require managers to consider the total cost, including the costs of acquisition, ownership, and post-ownership support.

We also observed that, after confronting a pandemic that led to severe supply and demand disruptions, many companies are emphasizing risk mitigation and robustness. It is yet to be seen, however, if some compa-

nies will feel they overreacted and revert to their pre-pandemic weighting of cost and risk once the pandemic is over.

For a company to make informed decisions and efficiently manage its supply chain resilience, it must quantify and evaluate all additional costs and weigh those costs against the risks.

Furthermore, as with any other cross-functional goal, division managers will have to consider the costs and benefits of their decisions throughout the firm to achieve resilience. Companies might want to institute reward schemes and key performance indicators (KPIs) to incentivize individual product managers and business units to collaborate. Such cross-functional collaboration has been difficult to achieve in the past due to the challenges in quantifying the costs of failure and the benefits of success. But the COVID-19 pandemic has provided a motivation to re-examine this issue.

4. Limited resources for change (Resource trade-off).

Of course, robustness, resilience, and supply chain risk management are familiar terms for most supply chain executives. These concepts are included in most supply chain strategy roadmaps. But when resources run low, and even more so during a pandemic, focusing on more than one major supply chain initiative can be challenging. Many of our interviewees shared that their manufacturing entities had already begun digitizing their supply chains, knowing that end-to-end visibility is necessary to create efficient supply chain resilience. The COVID-19 pandemic simply accelerated their ongoing digitalization processes. On the other hand, companies who

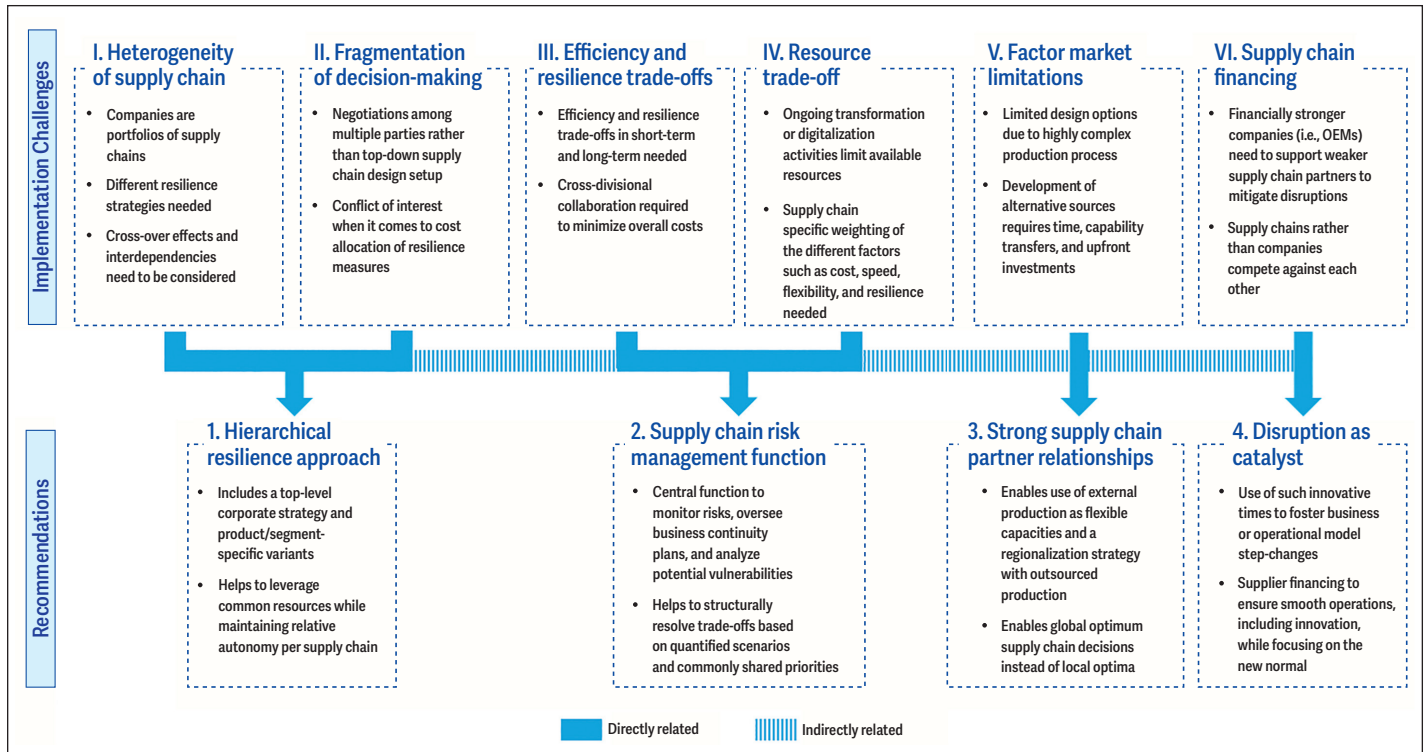
were undergoing post-merger or post-acquisition integration found that their supply chains were more vulnerable to external disruptions.

At the end of the day, every company needs to balance its efforts between ongoing transformation activities, day-to-day business management, and the implementation of new forward-looking strategies. Most companies have limited resources and multiple demands and priorities that affect how they choose to use those resources. It may be challenging, therefore, to get everyone onboard with the idea of investing in resilience, especially when resilience strategies often require upfront investments and pay off only in the longer term, if at all. According to our respondents, managers were more willing to invest in resilience strategies if they had experienced difficulties in regaining their market position after previous disruptions. In such cases, additional expenses were both easier to justify and perceived as a cost-effective 'insurance policy'. In general, if executives want to achieve resilience, they need to embrace a long-term view without the expectation of quick returns. Furthermore, companies need to optimize their trade-offs according to their own specific constraints, including limitations in their free cash flow, management capacity, and ability to pivot.

5. Factor market limitations.

The interviewees shared that their ability to realize an ideal supply chain configuration depended heavily on factor markets. In contrast to the limitations of internal resources, external limitations require interaction and coordination

Figure 3: Summary of implementation challenges and the corresponding recommendations



outside the boundaries of the firm. Furthermore, companies that have more complex and specialized production processes, for example high-tech companies, will have fewer supply chain options to choose from. This might result in a company being forced to accept whatever supply chain is offered to them by qualified contract manufacturers or suppliers. Original equipment manufacturers (OEMs) should thus look at the entire, multi-tier, supply chain factor market. Having resilient final manufacturing processes might not help if the upstream portions of the supply chains are insufficiently diversified.

Since these limitations require long-term investments in alternative sources of supply, they can make it even harder for companies to implement resilience strategies. Vetting the needed suppliers often involves

assessing both their technical and business capabilities, as well as their geographical reach. Even when a company adopts a long-term view, the process can be derailed by firefighting, especially during turbulent times. This can leave companies without a viable second source or contingency plan.

6. Supply chain financing and insufficient government incentives.

We focused our interviews on large, successful companies, for whom financing is usually

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not a critical obstacle to supply chain resilience. But even these companies recognized that certain parts of their supply chains may be weaker than others and thus require additional financial or technical support. Such cross-company collaboration can be critical since the resilience of a supply chain tends to be defined by its weakest link. Ultimately, the competition is not company versus company but supply chain versus supply chain. Perhaps because of this, many companies have gone beyond the basic elements of collaboration by changing the division of labor among the partners (customers or suppliers) to achieve a higher level of coordination. Vendor managed inventory (VMI), where the supplier is given the authority to place orders for the customer, is one example of such a strategy. During a supply chain crisis such as the one caused by the COVID-19

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pandemic, it is even more imperative to take such measures.

Another determinant of companies' success in implementing a resilient supply chain strategy is governmental incentives and support. The various governments that our interviewees deal with on a regular basis reacted to the pandemic in vastly different and not always transparent or steadfast ways.

Governments often have their own objectives and interests in mind when making policies, regardless of whether those policies will become obstacles or provide support to companies wanting to build resilience. But the right government support can make it easier for a company to make the necessary adjustments.

Overall, the supply chain executives revealed that the multiple challenges facing

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companies trying to achieve supply chain resilience intensify during disruptions such as the COVID-19 pandemic. The most significant of these challenges include heterogeneity of supply chains, factor market limitations, and supply chain design differences.

Key takeaways and recommendations

Based on our interviews we recommend a series of actions companies can take that will not only enhance their supply chain resilience but also help them overcome the main challenges for implementing their supply chain strategies (see Figure 3). While it is probably too early to tell which companies will emerge from the pandemic successfully, we observed that the ones that started thinking about resilience and crisis management before the pandemic have a discernible advantage. We devised the following recommendations based on the best practices conveyed to us by these companies.

Companies with a wide product portfolio should implement a hierarchical approach to enabling resilience that includes a top-level corporate strategy and product/segment-specific variants.

All the interviewees agreed that no single supply chain design can efficiently serve companies that manufacture a variety of products in different countries and sell to different customer bases (Challenge I in Figure 3). Rather, the right setup should be determined by assessing a company's specific product, market, and customer characteristics. The ability to differentiate a company's supply chain needs is thus essential to designing an effective supply chain strategy.

We recommend using a hierarchical approach with two or three levels to help define a resilience strategy while avoiding the prob-

lems that arise from the heterogeneity of supply chains. The first level in the hierarchical approach is the corporate level. During a major disruption, managers at the corporate level can supervise standardization across the entire organization and encourage collaboration, resource sharing, and learning across multiple business units. The second level can be a region or business unit, including products, segments, or region-specific entities. At this level, each entity is responsible for designing the ideal supply chain for its respective product group. While this will likely result in different supply chains, they will all be governed by the company's overall corporate strategy. It will also avoid the common challenge of fragmented decision making (Challenge II in Figure 3) by incorporating it into the overall supply chain design. This makes it easier to include external manufacturing sites as well as independent internal business units within the firm's supply chain decision-making structure.

One of the companies we interviewed that successfully implemented this approach manufactures products and provides engineering services for a wide range of industrial, commercial, and consumer markets. Despite having an array of offerings, multiple supply chains, and a complex sourcing network (sourcing about 1 million stock keeping units from over 20,000 suppliers) the company managed to navigate the pandemic with minimal impact to its level of customer service.

The key to successfully maintaining operations and supply chain performance for this company was its hierarchical approach for enabling resilience. The company's first level of corporate strategy is designed to set guidelines and standards across all business units, for contracts, dual sourcing, and go-to market strategies. It is also

designed to leverage commodities where scale matters, for example steel, electronics, and the internally operated logistics network. At this company, the corporate level manages the business units and their final outcomes by using a series of performance metrics such as lead time and customer service satisfaction. The company's second level allows its independent business units to design their own supply networks specific to their product and geography. This was particularly helpful because 75-85 percent of the company's products sold in a particular marketing region were both sourced and manufactured in that region.

The company operates regional supply chains through three hubs: Asia, Europe, and North America. Because the company had already set up mechanisms to share or pool its inventory across multiple regions, it greatly reduced its exposure to recent regional disruptions such as tariffs, trade-wars, and the COVID-19 pandemic. The company has also minimized the downside of a regional decentralized setup by leveraging its raw materials and commodity components as much as possible. And it has accomplished this while preserving flexibility by virtue of its internal global logistics operations.

Establish an independent supply chain risk management (SCRM) function within the organization.

Instead of completely rethinking the current supply chain setup and strategy, the companies we interviewed accelerated certain aspects of their strategy which they had already planned to implement over the next couple of years. The pandemic essentially helped speed things up. For example, the increase in remote working that was caused by the pandemic falls under two common areas of improvement the companies were already working on: digitalization of the supply chain and organization-

al processes, and the integration of external partners, such as contract manufacturers, suppliers, and distributors. Our interviewees revealed that resilience is thus far from being a new topic for many supply chain executives. The pandemic crisis simply forced a re-evaluation of strategy and trade-offs. Companies found themselves assessing the importance of cost, speed, and agility, and ultimately gave more weight to agility and risk mitigation.

Many of the companies we interviewed also mentioned the need for a central portal of information where analysis can be visible to all and resilience plans executed transparently. In the long run, resilience depends upon a company's ability to constantly monitor risks and have business continuity plans on stand-by. This may require some companies to create a supply chain risk management (SCRM) function whose purpose is to centrally manage efficiency and resiliency trade-offs (Challenge III in Figure 3) and effectively allocate resources (Challenge IV) within the supply chain organization. One of the challenges for effective business continuity is maintaining end-to-end visibility across multiple tiers of suppliers and distributors. A SCRM function would directly benefit from end-to-end visibility, end-to-end control, and organizational readiness (three of the four enablers mentioned in Figure 1).

Cisco, a high-tech telecommunications company, understood this over a decade ago and acted accordingly by outsourcing production. This allowed Cisco to remain flexible in terms of designing an optimal supply chain. While this could hinder end-to-end visibility and direct control over the supply chain to preempt or contain disruptions, Cisco managed to become a role model with respect to SCRM, nevertheless.

Initiating its resilience strategy in 2010, Cisco was one of the first

globally operating companies to set up a SCRM function. The company's basic approach was to design a supply chain based on product and market considerations along with boundary conditions that reflected the company's economics. From 2010 onwards, Cisco applied a risk lens when designing or assessing its supply chains. This led the company to implement several resilience measures such as proactively de-risking identified geographic risks by allowing qualifying foreign suppliers to regionalize their sourcing of key components. While such measures can increase cost and network complexity, they also serve as an insurance policy. In Cisco's case, every disruption felt by the industry since then, including the major material shortage in 2010, the Japan earthquake in 2011, and the Thailand floods in 2011, validated the firm's approach. Furthermore, on a regular basis Cisco practices its crisis response and fine-tunes its supply chain designs. Consequently, the COVID-19 pandemic resulted in minimal impact to Cisco's customer service levels despite the increase in demand for its key products.

Companies that (at least partly) manufacture at external production facilities should invest in strong relationships with their suppliers and contract manufacturers.

Much has been written about when it is appropriate to develop deep partnerships versus when it is better to maintain arms-length transactional relationships. We observed, however, that companies are placing more emphasis on partnerships. The reasons for doing so changed during the current crisis.

When comparing the advantages and disadvantages of different manufacturing locations, the unanimous view is that no country or

region is dominant. Given the risk levels that the pandemic revealed, even China may no longer be the preferred manufacturing location for many industries. Companies that have traditionally relied on a single country have started to de-risk their supply chain by considering back-up locations. And they expect their strategic suppliers to do the same. This helps to explain the decrease in re-shoring activities since the pandemic. When a disruption is global, even with back-up locations, there is no guarantee that a complete shutdown of operations can be avoided. When the disruption is localized, however, or when it hits different regions at different times, having back-up locations enables companies to operate for longer and re-start sooner, as the different regions recover over time.

Long-term collaborative partnerships are especially helpful for companies that are facing significant constraints in their factor markets (Challenge V in Figure 3) and/or who rely solely on partners for manufacturing. Strong relationships with suppliers provide an OEM with partners who are willing to invest in upgrading their manufacturing capabilities and diversifying their supply chain footprints. Relationships of this kind also facilitate the exchange of information which is a key ingredient in developing an integrated production network.

One of the interviewed companies that focuses on storage and network technology emphasized its reliance on strong relationships with partners. Like many other information technology companies, it has outsourced most of its production and therefore does not have access to the full range of supply chain strategy options. Rather, it inherits the constraints of its contract manu-

facturers which strongly limit its choices and leaves it more susceptible to disruptions. This is why the company has invested in the partner network strategy (one of the resilience strategies from Figure 1).

This company's close collaboration with its suppliers, such as developing new products through a joint design and manufacturing (JDM) approach, has fostered strong relationships and bolstered its reputation as a trustworthy partner. Suppliers are more willing to share risks and costs with this company, for example by accepting performance-based contracts. Such relationships create resilience because the suppliers are willing to invest in new capabilities and production facilities to support the company's regionalization strategy and give preferential treatment during actual disruptions.

Another interviewed company, a major player in the apparel industry, also gains resilience from its relationships with manufacturing partners. One of the fundamental features of this company's supply chain strategy is the inclusion of its key partners when it builds new capabilities in less developed countries. Unlike many of its competitors, during the pandemic this company continued paying its suppliers instead of canceling orders. This demonstrated a willingness to face the crisis together. These relationships will be critical as the firm explores ways to manufacture directly in its main consumer markets.

Use disruptions as a catalyst for business or operating model changes especially when facing a demand-side disruption.

Disruptions create an opportunity for pragmatic, solution-oriented thinking, which make it easier to bypass the mindsets and organi-

zational barriers that contribute to inertia.

Many of the resilience measures that companies usually implement to mitigate supply-side disruptions, such as multi-sourcing, inventory and capacity buffers, and ecosystem partnerships, can be expensive but relatively easy to control. In contrast, sudden demand-side disruptions can pose existential threats to some businesses, especially if those disruptions are long-term and profoundly affect demand. The companies that use these periods of disruption to achieve step-changes in their business models generally emerge the most successful.

We observed several step-changes that companies are using to mitigate those demand disruptions, including pivoting and diversification activities with respect to markets, product portfolio, and distribution channels. For example, one strategy that companies are deploying to cope with the shutdown of retail stores is shifting their volume from classical offline distribution to internet sales. Another strategy which has helped some companies overcome the crisis is streamlining their product portfolio down to the most valuable stock-keeping-units. Yet another strategy is re-purposing production facilities to manufacture the most needed products such as hygiene products or ventilators. Companies therefore do have options to mitigate demand disruptions, but only to a certain point. These options usually involve rather drastic operating or business model changes.

Most companies during the pandemic focused primarily on dealing with the forced digitalization of internal processes and communications, since the majority of their employees suddenly needed to work from home. One healthcare-related consumer products company realized before the pandemic that its

current supply chain solution did not serve all its customers. During the crisis, the company turned out to be rather resilient and therefore had the time and resources to make changes to its operating model. Using the disruption as a stimulus, the company changed its product classification methodology from an elaborate version of the ABC classification (a ranking system for identifying and grouping items in terms of how useful they are for achieving business goals) into a new segmentation model that assesses products by both their potential risk for disruption to the supply chain and their potential growth in the market. The company has been very proactive in understanding risk through an enterprise-wide risk management system that explicitly incorporates different forms of risk and analyses, both their medium and long-term impacts. This new segmentation is the basis for the company's 2025 strategy to develop built-in resilience by matching the supply chain design to product-specific supply and demand characteristics.

Conclusion

Managers generally understand the basic roadmap to supply chain resilience, and yet implementing and executing it remains a challenge. We developed a framework to support successful implementation by identifying the principal challenges for achieving resilience and effective responses to these challenges. We introduced an integrative framework for supply chain resilience (Figure 1), which combines enablers, such as end-to-end visibility, with resiliency strategies.

Existing enablers and supply chain resilience strategies are sufficient for most companies in normal times. The COVID-19 pandemic, however, pushed companies to consider the intense interactions and multiple tradeoffs of the full range of resilience strategies. Reactive strategies can stop the bleeding, but they are not sufficient in the long run. Proactive strategies thus need to be developed, analyzed, and implemented.

We observed six challenges to the implementation of resilient supply chain strategies and developed

Disruptions create an opportunity for pragmatic, solution-oriented thinking, which can make it easier to bypass the mindsets and organizational barriers that contribute to inertia.

recommendations for how to overcome them. These findings are based on best practice examples as observed in the companies that we interviewed. These challenges show that the right supply chain setup depends on individual weighting of multiple factors as well as dealing with a multiplicity of trade-offs that change over time. It is difficult for a company to invest in resilience proactively and efficiently, and almost impossible for a company to do so if it has not already installed a dynamic supply chain risk management process. ■

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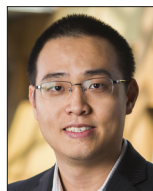
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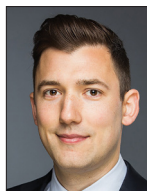
Author Bios



Morris A. Cohen is the emeritus Panasonic Professor of Manufacturing and Logistics in the Operations, Information and Decisions Department of The Wharton School, The University of Pennsylvania in Philadelphia, Pennsylvania. cohen@wharton.upenn.edu



Shiliang Cui is an Associate Professor of Operations and Information Management in the McDonough School of Business at Georgetown University in Washington, DC. shiliang.cui@georgetown.edu



Sebastian Doetsch recently graduated with a doctoral degree from the Chair of Production Management of WHU's Otto Beisheim School of Management in Vallendar. sebastian.doetsch@whu.edu



Ricardo Ernst is the Baratta Chair in Global Business and Professor of Operations and Global Supply Chain Management at the McDonough School of Business at Georgetown University in Washington, DC. ernstr@georgetown.edu



Arnd Huchzermeier is a Chaired Professor of Production Management at WHU's Otto Beisheim School of Management in Vallendar. arnd.huchzermeier@whu.edu



Panos Kouvelis is the Emerson Distinguished Professor of Operations & Manufacturing Management, and Director of The Boeing Center for Supply Chain Innovation (BCSCI) in the Olin Business School at Washington University in St. Louis, Missouri. kouvelis@wustl.edu



Hau Lee is the Thoma Professor of Operations, Information, and Technology at the Graduate School of Business at Stanford University in Stanford, California. haulee@stanford.edu



Hirofumi Matsuo is Professor of Operations Management at the Tokyo International University. hmatsuo@tiu.ac.jp



Andy A. Tsay is a Professor of Business and Analytics in the Leavey School of Business at Santa Clara University in Santa Clara, California. atsay@scu.edu

Endnotes

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