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Global Supply Chains in a Post-Pandemic World

Companies need to make their networks more resilient. Here's how.

by Willy C. Shih

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Global Supply Chains in a Post-Pandemic World

Companies need to make their networks more resilient. Here's how.

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ABOUT THE ART

Christoph Morlinghaus is a photographer based in Hamburg whose work explores space and architecture. These photos were taken in various fulfillment centers and manufacturing plants in California and Germany.

When

the Covid-19 pandemic subsides, the world is going to look markedly different. The supply shock that started in China in February and the demand shock that followed as the global economy shut down exposed vulnerabilities in the production strategies and supply chains of firms just about everywhere. Temporary trade restrictions and shortages of pharmaceuticals, critical medical supplies, and other products highlighted their weaknesses. Those developments, combined with the U.S.-China trade war, have triggered a rise in economic nationalism. As a consequence of all this, manufacturers worldwide are going to be under greater political and competitive pressures to increase their domestic production, grow employment in their home countries, reduce or even eliminate their dependence on sources that are perceived as risky, and rethink their use of lean manufacturing strategies that involve minimizing the amount of inventory held in their global supply chains.

Yet many things are *not* going to change. Consumers will continue to want low prices (especially in a recession), and firms won't be able to charge more just because they manufacture in higher-cost home markets. Competition will ensure that. In addition, the pressure to operate efficiently and use capital and manufacturing capacity frugally will remain unrelenting.

The challenge for companies will be to make their supply chains more resilient without weakening their competitiveness. To meet that challenge, managers should first understand their vulnerabilities and then consider a number of steps—some of which they should have taken long before the pandemic struck.

Uncover and Address the Hidden Risks

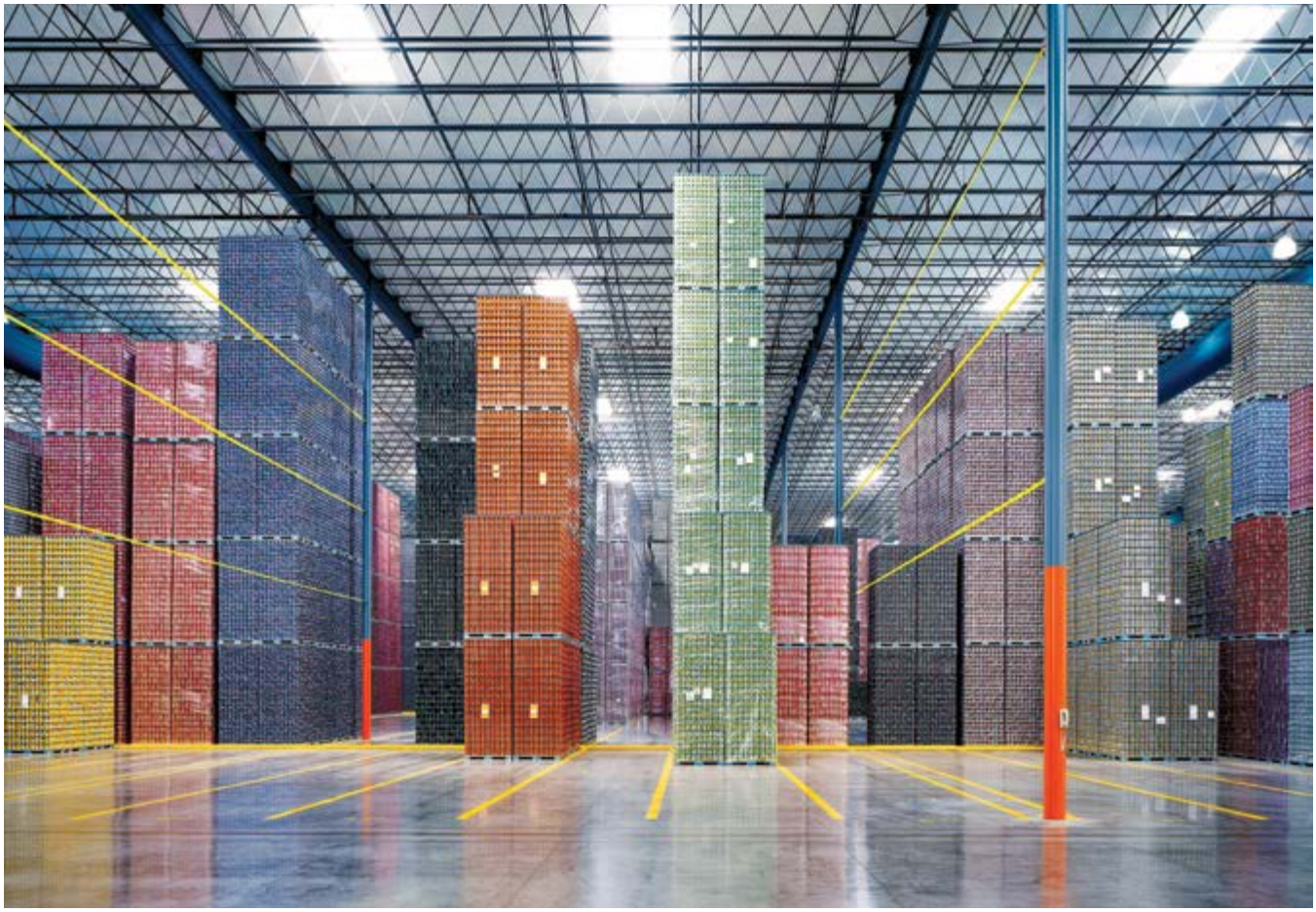
Modern products often incorporate critical components or sophisticated materials that require specialized technological skills to make. It is very difficult for a single firm to possess the breadth of capabilities necessary to produce everything by itself. Consider the growing electronics content in modern vehicles. Automakers aren't equipped to create the touchscreen displays in the entertainment and navigation systems or the countless microprocessors that control the engine, steering, and functions such as power windows and lighting. Another more arcane example is a group of chemicals known as nucleoside phosphoramidites and the associated reagents that are used for creating DNA and RNA sequences. These are essential for all companies developing DNA- or mRNA-based Covid-19 vaccines and DNA-based drug therapies, but many of the key precursor materials come from South Korea and China.

IDEA IN BRIEF

THE PROBLEM
Disruptions and shortages during the Covid-19 pandemic exposed weaknesses in global supply chains, which already faced threats from trade wars.

THE CAUSE
Many companies hadn't rigorously identified and addressed hidden vulnerabilities.

THE SOLUTION
Thoroughly map your supply chain to uncover risks. To mitigate them, line up alternative supply sources in diverse locations or increase stocks of critical materials. Revisit your product strategies. And explore new manufacturing technologies that could increase flexibility and resilience.



Manufacturers in most industries have turned to suppliers and subcontractors who narrowly focus on just one area, and those specialists, in turn, usually have to rely on many others. Such an arrangement offers benefits: You have a lot of flexibility in what goes into your product, and you're able to incorporate the latest technology. But you are left vulnerable when you depend on a single supplier somewhere deep in your network for a crucial component or material. If that supplier produces the item in only one plant or one country, your disruption risks are even higher.

Identify your vulnerabilities. Understanding where the risks lie so that your company can protect itself may require a lot of digging. It entails going far beyond the first and second tiers and mapping your full supply chain, including distribution facilities and transportation hubs. This is time-consuming and expensive, which explains why most major firms have focused their attention only on strategic direct suppliers that account for large amounts of their expenditures. But a surprise disruption that brings your business to a halt can be much more costly than a deep look into your supply chain is.

The goal of the mapping process should be to categorize suppliers as low-, medium-, or high-risk. To do that, Tom Linton, who served as a supply chain executive at several major companies, and MIT's David Simchi-Levi suggest applying metrics such as the impact on revenues if a certain source is lost, the time it would take a particular supplier's factory to recover from a disruption, and the availability of alternate sources. (Disclosure: I am on the boards of directors of Flex, a large manufacturing and supply-chain services provider where Linton is a senior adviser, and Veo Robotics, a company that has developed an advanced vision and 3D sensing system for industrial robots.) It's vital to ascertain how long your company could ride out a supply shock without shutting down, and how quickly an incapacitated node could recover or be replaced by alternate sites when an entire industry faces a disruption-related shortage.

The answers to those questions depend, in part, on whether your manufacturing capacity is flexible and can be reconfigured and redeployed as needs evolve (as is the case for many manual or semiautomated assembly operations) or

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whether it consists of highly specialized and difficult-to-replicate operations. Examples of the latter include production of the most advanced smartphone chips, which is concentrated in three facilities in Taiwan owned by the Taiwan Semiconductor Manufacturing Company; fabrication of exotic sensors and components, which happens largely in highly specialized facilities in a handful of countries, including Japan, Germany, and the United States; and refining of neodymium for the magnets in AirPods and electric-vehicle motors, almost all of which is done in China.

Once you've identified the risks in your supply chain, you can use that information to address them by either diversifying your sources or stockpiling key materials or items.

Diversify your supply base. The obvious way to address heavy dependence on one medium- or high-risk source (a single factory, supplier, or region) is to add more sources in locations not vulnerable to the same risks. The U.S.-China trade war has motivated some firms to shift to a "China plus one" strategy of spreading production between China and a Southeast Asian country such as Vietnam, Indonesia, or Thailand. But regionwide problems like the 1997 Asian financial crisis or the 2004 tsunami argue for broader geographic diversification.

Managers should consider a regional strategy of producing a substantial proportion of key goods within the region where they are consumed. North America might be served by shifting labor-intensive work from China to Mexico and Central America. To supply Western Europe with items used there, companies could increase their reliance on eastern EU countries, Turkey, and Ukraine. Chinese firms that want to protect their global market share are already looking to Egypt, Ethiopia, Kenya, Myanmar, and Sri Lanka for low-tech, labor-intensive production.

Reducing dependency on China will be easier for some products than others. Things like furniture, clothing, and household goods will be relatively easy to obtain elsewhere because the inputs—lumber, fabrics, plastics, and so forth—are basic materials. It will be harder to find alternative sources for sophisticated machinery, electronics, and other goods that incorporate components such as high-density interconnect circuit boards, electronic displays, and precision castings.

Building a new supplier infrastructure in a different country or region will take considerable time and money, as China's experience illustrates. When China first opened its special economic zones in the 1980s, it had almost no indigenous suppliers and had to rely on far-flung global supply chains and on logistics specialists who procured materials from around the world and kitted them for assembly in Chinese factories. Even with the support of government incentives, it took 20 years for the country to build a local base capable of supplying the vast majority of electronic components, auto parts, chemicals, and drug ingredients needed for domestic manufacturing.

Shifting production from China to Southeast Asian countries will necessitate different logistics strategies as well. Unlike China, those locations often do not have the efficient, high-capacity ports that can handle the largest container ships or the direct marine liner services to major markets. That will mean more transshipment through Singapore, Hong Kong, or other hubs and longer transit times to reach markets.

In the long run, though, it would be a mistake to cut China completely out of your supply picture. The country's deep supplier networks, its flexible and able workforce, and its large and efficient ports and transportation infrastructure mean that it will remain a highly competitive source for years to come. And because China has the second-largest economy in the world, it is important that firms maintain a presence to sell in its markets and obtain competitive intelligence.

Hold intermediate inventory or safety stock. If alternate suppliers are not immediately available, a company should determine how much extra stock to hold in the interim, in what form, and where along the value chain. Of course, safety stock, like any inventory, carries with it the risk of obsolescence and also ties up cash. It runs counter to the popular practice of just-in-time replenishment and lean inventories. But the savings from those practices have to be weighed against all the costs of a disruption, including lost revenues, the higher prices that would have to be paid for materials that are suddenly in short supply, and the time and effort that would be required to secure them.

Take Advantage of Process Innovations

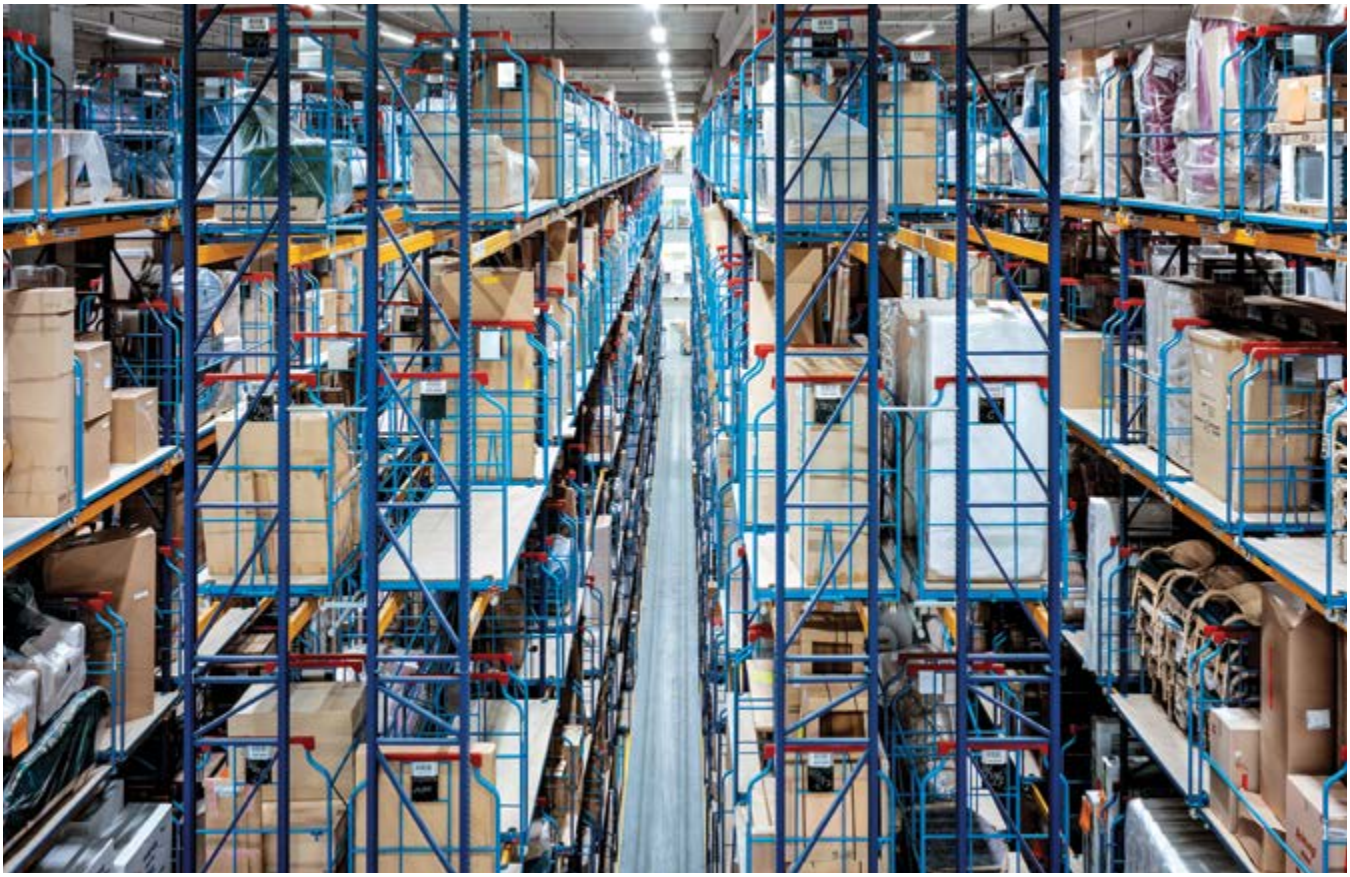
As firms relocate parts of their supply chain, some might ask their suppliers to move with them, or they might bring some production back in-house. Either course—transplanting a production line or setting up a new one—is an opportunity to make major process improvements. This is because as part of the change, you can unfreeze your organizational routines and revisit design assumptions underpinning the original process. (One challenge for companies with existing production lines is that when those assets are fully depreciated, executives may be tempted to retain them rather than invest in newer, more competitive plants and equipment:

FURTHER READING

"Bringing Manufacturing Back to the U.S. Is Easier Said Than Done"
Willy C. Shih
HBR.org, April 15, 2020

"It's Up to Manufacturers to Keep Their Suppliers Afloat"
Tom Linton and Bindiya Vakil
HBR.org, April 14, 2020

"Coronavirus Is a Wake-Up Call for Supply Chain Management"
Thomas Y. Choi, Dale Rogers, and Bindiya Vakil
HBR.org, March 27, 2020



Since the depreciation expense is no longer factored into the calculated cost of production, the marginal cost of boosting production at a plant with idle capacity is lower.)

Several years ago I spent a week at a new Chinese factory of a major American industrial-equipment company. When creating it, the company had started with the designs of its U.S. and Japanese factories and then improved on them by introducing newer equipment and ways of working. The result was a streamlined operation that was much more efficient than those in the United States and Japan. When the company built its next new factory—in the United States—it repeated the process, using the Chinese factory as the starting point. Another example is the Flex factory complex in Guadalajara, Mexico. When increases in productivity plateaued, the company often moved smaller assembly lines to another building (or part of the same building). During each move, workers redesigned steps to use less space and less labor, boosting productivity.

New technologies already or soon will allow companies to lower their costs or switch more flexibly among the products they manufacture, rendering obsolete the installed bases of incumbent competitors or suppliers. Many of these advances also present an opportunity to make factories more environmentally sustainable. Examples include the following:

→ ***Automation:*** As the cost of automation declines and people see that robots can operate safely alongside humans, more kinds of work are being automated. The pandemic has made automation even more attractive, because social

"Coronavirus Is Proving We Need More Resilient Supply Chains"
Tom Linton and Bindiya Vakil
HBR.org, March 5, 2020

"The 3-D Printing Playbook"
Richard A. D'Aveni
HBR, July–August 2018

"Find the Weak Link in Your Supply Chain"
David Simchi-Levi
HBR.org, June 9, 2015

"From Superstorms to Factory Fires: Managing Unpredictable Supply-Chain Disruptions"
David Simchi-Levi, William Schmidt, and Yehua Wei
HBR, January–February 2014

"Innovation Killers: How Financial Tools Destroy Your Capacity to Do New Things"
Clayton M. Christensen, Stephen P. Kaufman, and Willy C. Shih
HBR, January 2008

"Does America Really Need Manufacturing?"
Gary P. Pisano and Willy C. Shih
HBR, March 2012

"Restoring American Competitiveness"
Gary P. Pisano and Willy C. Shih
HBR, July–August 2009

distancing in factories is now a necessity. As a result of these developments, it's becoming more practical to return offshored production to higher-cost countries. Robotic palletizers, which can sharply reduce the need for labor in preparing products for shipping, will pay for themselves quickly, as will automated optical inspection systems for quality control.

→ ***New processing technologies:*** The latest chemical manufacturing equipment uses less energy and solvents, produces less waste, is less capital-intensive, and is less expensive to operate. Similarly, a new generation of compact bioreactors could allow makers of biopharmaceuticals and vaccines to produce smaller batch sizes economically.

→ ***Continuous-flow manufacturing:*** This innovation could significantly increase the resilience of the supply chain for small-molecule generic drugs by making producers less dependent on imported active pharmaceutical ingredients (APIs). The U.S. Defense Advanced Research Projects Agency (DARPA) has funded one initiative in this area: the development of flexible miniaturized manufacturing platforms and methods for producing multiple APIs from shelf-stable precursors as specific medical needs arise.

→ ***Additive manufacturing:*** This production method, also known as 3D printing, can dramatically reduce the number of steps required to make complex metal shapes; it can also lessen dependence on distant suppliers of the machinery and tools needed for, say, the injection molding of plastics. Rapid advances in 3D printing are making it possible to economically produce an ever-expanding array of items in much higher quantities.

In many industries, technologies such as these promise to upend the traditional strategy of seeking economies of scale by concentrating production in a few large facilities. They will allow companies to replace large plants that serve global markets with a network of smaller, geographically distributed factories that is more resistant to disruption.

Revisit the Trade-Off Between Product Variety and Capacity Flexibility

During the pandemic, when demand surged in many product categories, manufacturers struggled to shift from supplying one market segment to supplying another, or from making one kind of product to making another. A case in point is the U.S. groceries market, where companies had difficulty adjusting to the plunge in demand from restaurants and cafeterias and the rise in consumer demand. SKU proliferation—the addition of different forms of the same product to serve different market segments—was partly responsible. For example, one obstacle to meeting heightened demand for toilet paper at supermarkets was that manufacturers had to change over their production lines, because consumers prefer soft multi-ply rolls rather than the thinner toilet paper that many hotels and offices purchased in much larger rolls. Adding to the complexity, different retail chains wanted their own packaging and assortments.

Researchers such as Barry Schwartz of Swarthmore College and Patrick Spenner, a consultant who was formerly at CEB (now part of Gartner), have long argued that more choice isn't always better. Separating demand into many different SKUs makes forecasting more difficult, and trying to fill needs by substituting products during periods of shortage causes a real scramble. The lesson: Companies should reconsider the pros and cons of producing numerous product variations.

THE ECONOMIC TURMOIL caused by the pandemic has exposed many vulnerabilities in supply chains and raised doubts about globalization. Managers everywhere should use this crisis to take a fresh look at their supply networks, take steps to understand their vulnerabilities, and then take actions to improve robustness. They can't and shouldn't totally back away from globalization; doing so will leave a void that others—companies that *don't* abandon globalization—will gladly and quickly fill. Instead, leaders should find ways to make their businesses work better and give themselves an advantage. It's time to adopt a new vision suitable to the realities of the new era—one that still leverages the capabilities that reside around the world but also improves resilience and reduces the risks from future disruptions that are certain to occur.

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