

# Supply Shortages: Here to Stay?

## The Roles Government and Emerging Tech Should Be Playing

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In the wake of the pandemic, global supply chain challenges have driven massive product shortages and rising prices on goods, from cars and building supplies to electronics, medicine and more. As the Delta variant causes COVID-19 surges across the United States, and the global response continues to be slow and uneven, hear from two of our leading experts on global supply chains. UNC Kenan-Flagler Business School Professor Jay Swaminathan and Professor Vinayak Deshpande weigh in below.

### What has been the immediate impact of the supply chain disruptions to business and society amid, and in the wake of, the pandemic?

**Jay:** The immediate effects of supply chain disruptions are in the form of shortages, price increases and long lead times for goods. Think about the toilet paper and PPE shortages we had immediately after the pandemic last year. More recently, take the example of a car or a home appliance, like a refrigerator. Because there is little inventory in the distribution channel, the net result is a long delay for customers. When this happens (for instance, in the new car market), customers may decide that they want to get what is available in the secondary market (in this case, used cars). As a result, we have seen a dramatic increase in used car prices. Something similar happened in lumber, where prices skyrocketed as a result of demand increase coupled with supply chain disruptions.

**Vinayak:** Such product shortages have affected a wide variety of business sectors ranging from consumer products to the technology sector (e.g., shortages of semiconductor chips). In many industries, this has resulted in increased prices as demand for products has outstripped supply during the pandemic. For example, TSMC, world's largest semiconductor chip maker, plans to increase the prices of its most advanced chips by roughly 10%, while less advanced chips used by customers like automakers will cost about

20% more. The shortage of supply and associated price increases will be felt by consumers and businesses in the near-term as supply chains continue to struggle due to the pandemic.

A consequence of this phenomenon is that businesses that depend on a global network of suppliers now face significant uncertainty in lead-times for their products, making supply chain planning very difficult. For example, manufacturing companies are struggling to schedule production because of uncertainty about availability of inputs needed for production. Toyota recently announced that it was cutting production in Japan by 40% in September because of a shortage of semiconductors, highlighting how the scarcity is hitting even the best-prepared companies. Ford Motor Co. and General Motors Co. also said that they are scheduling more downtime at several North American factories, in part because of virus-related restrictions overseas. Overall, planning has become more difficult due to the supply chain uncertainty created by the pandemic.

### What factors are supply chain experts in academia and industry looking at when assessing the return to more optimal global networks?

**Jay:** Clearly, for us to get back to the optimal global network, we need to have production capacities across the globe firing on all cylinders. In the last 25 years, supply chains have become increasingly global and tightly intertwined; therefore, disruption at any location has far-reaching effects. For example, the lower production levels at automobile plants in the US recently are mainly due to semiconductor and other critical part shortages, a result of COVID-related disruptions overseas.

The factors to consider (or watch) as we strive for normalcy relate to procurement lead time, transportation times, inventory buffer positions and factory capacity utilizations. As we attain more reasonable

estimates (or long-run averages) around these factors, we will better be able to ascertain whether we are tracking in the right direction.

**Vinayak:** The pandemic has brought a renewed focus in industry to managing risk and building resiliency. A key question that academia and industry are examining is on how to build agility and resilience in the supply chain. Agility is defined as the ability to respond rapidly and cost effectively to short term changes in demand or supply disruptions, while resilience is the ability to adapt to structural changes by modifying supply chain strategies, products and technologies.

A recent Gartner survey of industry practitioners found 55% of the participants expect to become “highly resilient” within the next two to three years, with those in retail, healthcare and pharmaceuticals among the most bullish. “Highly resilient” was defined by practitioners as having “good visibility to the supply network...and having the ability to conduct scenario planning for trade-offs in the network by shifting sourcing, manufacturing or distribution.” Academic research as well as industry initiatives are looking at a three-pronged strategy to enhance visibility, agility and resilience across global networks.

## What role, if any, does the U.S government have to play to help alleviate some of the business and consumer impacts of the supply chain disruption?

**Jay:** The U.S. government has done a lot with monetary and fiscal policies, which has helped with the demand side of the equation. The supply side of the equation is more challenging, as the task of transforming or changing production and distribution facilities located worldwide cannot be realized overnight. The government has realized more than ever before that U.S. firms have outsourced many (maybe too much) of their supply chains overseas, and it is indeed important to incentivize more investments in the country. The semiconductor initiative by the Biden administration is a positive step in this direction, but more are needed across other industries as well.

**Vinayak:** While I am not an expert on policy issues, I believe there are several things the U.S government can do to reduce the impact of supply chain disruptions. It can, for example, build buffer inventory of critical supplies that are needed to enhance safety and health. The Strategic National Stockpile (SNS) is part of the federal medical response infrastructure that carries safety stock of supplies, medicines, devices and PPE as a stopgap buffer when immediate

supplies of these materials may not be available. The U.S. government can also invest in infrastructure that facilitates global trade such as ports, information technology and more; to that end, U.S. ports and waterways are on track to receive more than \$11 billion in funding over the next five years as part of the infrastructure bill recently passed by the U.S. Senate. This will alleviate bottlenecks that can disrupt the flow of goods through global trade. Additionally, the U.S. government can invest in enhancing the cyber security of its infrastructure such as the power grid and gas pipelines. The recent hack of the Colonial Pipeline has exposed an additional dimension of risk that can result in supply chain disruptions.

## How have emerging technologies helped industry build more resilient supply chains? Did these technologies help alleviate some of the challenges faced by the unique circumstances of a global pandemic?

**Jay:** When I first started teaching my MBA elective, “Global Supply Chain Management,” more than 23 years ago, most of supply chain concepts revolved around flow of products. Today’s supply chains are not just about movement of physical products but the seamless integration of products and information. Technology plays a very important role in all this, whether it is in production planning, logistics and warehouse management, inventory tracking, e-commerce sales or omni-channel retail experience. Indeed, without the technology and the amazing supply chains we would have not survived the pandemic the way we did. When we (as customers) sit at home and order an item from Amazon (or any e-tailer) and it shows up like “magic” at our doorsteps, we have an invisible supply chain and myriad technologies to thank. This is just one example, think about UberEats, and deliveries from grocery stores - if we did not have the science and systems around supply chain management, the pandemic would have made our lives extremely difficult. We all should be grateful for the supply chain workforce in the country and worldwide whose efforts, in my opinion, are second only to the frontline health workers, in enabling us to navigate this terrible pandemic.

**Vinayak:** There are a number of technologies that hold the promise to make supply chains resilient, but we are not there yet. This includes technologies such as the Internet-of-Things (IoT); blockchains; machine learning and artificial intelligence; and additive manufacturing. While supply chain decision support systems (DSS) have existed for decades, newer methodologies from machine learning (ML) and artificial intelligence (AI) is changing the paradigm of these DSS. ML and AI techniques have provided better predictive capabilities to organizations that can help supply chains become more resilient.

While ML and AI have enhanced decision-making capabilities in supply chains, blockchain technology has the potential to bring transparency in supply chains. Given the complexity of global supply chains, supply chain partners need to collaborate across multiple tiers to drive resiliency. While blockchain's ability to capture data across a large number of supply chain partners is still unproven, it has the potential to overcome barriers to multi-tier supply chain collaboration. IoT is a vast array of interconnected sensors on machines, people, and products which, when combined with smart controllers, can take actions based on real-time sensor readings. IoT provides a "system view" of the supply chain and the environment and, hence, can increase transparency. Thus, IoT in combination with ML and AI has led to better supply chain planning due to improved visibility resulting in more granular and accurate forecasts. IoT has also enabled real-time monitoring of supply chains leading to faster and automated decisions. Additive manufacturing (also known as 3D-printing) can also make supply chains more resilient by reducing product design cycle times due to rapid prototyping, resulting in faster introduction of products to market. Additive manufacturing can also increase resiliency in supply chains by reducing the need to hold buffer inventory, as products/components can be manufactured on demand when and where they are needed.

## What might be the long-term impacts of the pandemic on industries reliant on global supply chains?

**Jay:** Global supply chains are indispensable, and the pandemic has brought to light the need to understand the risks of too much offshoring. In the long run, firms will strive to have stronger, more resilient and highly dependable global supply chains.

**Vinayak:** Companies are now taking a 360-degree view and re-evaluating strategies that will help them become more resilient. Organizations are taking a closer look at their supply networks, evaluating their exposure and often finding risk in unexpected places. For example, NASA recently took the unexpected step to ground a September satellite launch due to pandemic-related shortages of liquid oxygen, while Elon Musk and SpaceX have also acknowledged liquid oxygen shortages as a risk factor. In the long-term, firms will need and develop the capability to **evaluate, measure and optimize** agility and resilience of supply chain strategies.

These new risk factors will force long-term structural changes in supply chain networks. For some firms, this might mean reduced reliance on a single source of supply through a multi-sourcing strategy. While many supply chains have embraced principles of "lean" manufacturing, some firms may move away from a lean strategy by

holding strategic buffer inventories in their supply chains. Companies in the long term may also diversify their manufacturing networks to reduce exposure to several risk factors in the supply chain. "On-shoring" or "near-shoring" also may be a strategy deployed by firms to give them the ability to react faster to supply chain disruptions. Companies in the long-term may also redesign their products, or use common platforms for their products, or pool capacity across multiple manufacturing plants to help them hedge their bets against various supply chain disruptions. In the long term, we are probably going to see a fundamental shift in supply chain network strategy to enhance agility and resilience.

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## RESEARCH & RESOURCES

[The Unchaining of Supply Chains: Dismantling Disruption and Risk in the Post-COVID World](#)

[Seven Forces Reshaping the Economy Amid and Beyond COVID-19](#)

[Where Did All the PPE Go? The COVID-19 Disconnect Between Hospitals and the Healthcare Supply Chain](#)

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