



Supply Chain Resilience Report 2021 Update

Industry trends and supply chain strategy
for manufacturing

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75%

of companies have experienced externally caused disruptions to their supply chain in the past year

64%

of companies consider supply disruptions a serious concern

63%

of companies have implemented measures in the past year to build supply chain resilience

57%

of companies believe diversifying their supply chain is the best way to avoid disruptions in the future

98%

of companies believe measures should be taken to avoid future supply chain disruptions

56%

of companies have experienced more supply chain disruptions this year than last year

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Introduction

Supply chain resilience - what it means and why it matters

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Complex manufacturing supply chains face more risks than ever. A disruption in one country ripples around the world, leaving unprepared companies to experience damaging interruptions. Simultaneously, the number of disruptions is rising. As each risk has unique elements and timing, planning and prediction is impossible. Traditional strategies don't support the flexibility and adaptability required to survive, let alone grow stronger.

But some organizations react to disruption far better than others. These organizations cope with unknown and unknowable risks due to one characteristic: resilience.

Defining supply chain resilience

Supply chain resilience describes a supply chain prepared for unforeseen disruptions, that's able to react and recover quickly, and emerge stronger

Supply chain resilience describes a supply chain prepared for unforeseen disruptions, that's able to react and recover quickly, and emerge stronger after the event.

Though many companies believe supply chain resilience merely implies the ability to manage risk, true resilience enables you to position your organization better than competitors in order to deal with and gain advantage from disruptions.^[1]

Resilience is not a new concept, but the need for it has become greater as the frequency and severity of risks have increased, which comes naturally with an evermore complex, globally stretching supply chain. Supply chain resilience does not develop passively, as it's impossible to plan for every potential risk. Instead, it demands a dedicated, deliberate strategy to strengthen your organization in the face of the unexpected.

Resilience is crucial to the manufacturing industry, as generating revenue relies on adding value at each link of the supply chain, from the raw materials to the finished product. If one of these links becomes broken, or disrupted, value can no longer be added, making a resilient supply chain essential to bringing products to market.

The rising need for resilience

From trade wars and material shortages to COVID-19 and changing labor environments, supply chain resilience is becoming a priority for many companies. The rise of global trade means companies have more moving pieces stretched over greater distances with less slack in the system. And with a growing global population and a growing economy, significant supply chain disruptions are inevitable.^[02]

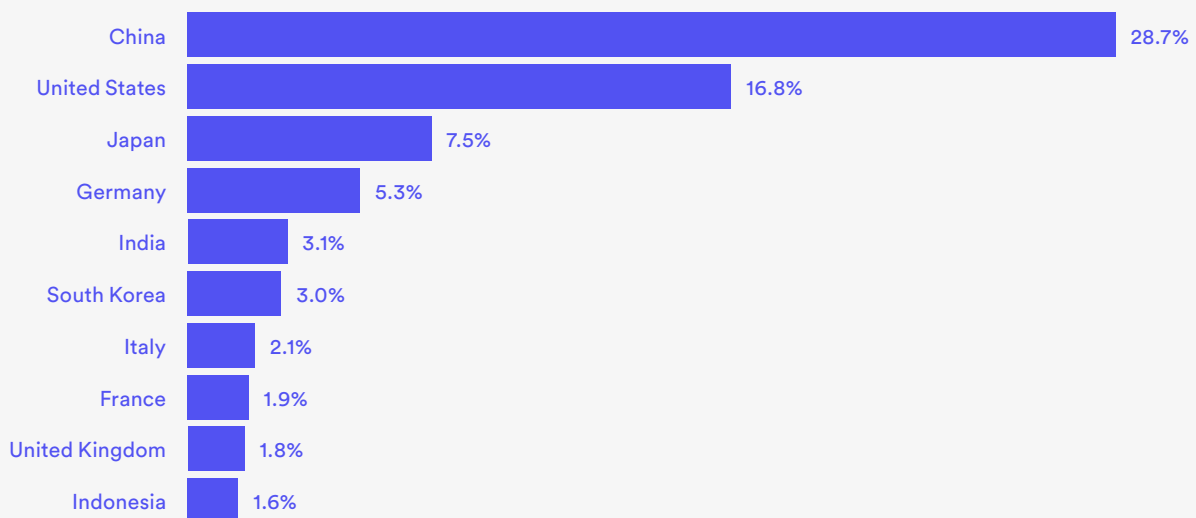
Simultaneously, companies are still relying on a single company for certain parts in order to achieve lower costs.^[03] Reducing essential processes and resources to a single or a few sources creates a dependency on deep-tier suppliers as well as on concentrations of supply sources that create fragile chokepoints in the global economy. Only a handful of countries are responsible for the world's supply (see Figure 1) and, as many companies experienced with the COVID-19 outbreak, this over-reliance can have catastrophic long-term effects on supply chain operations.

Disruptive events can have material impacts on financial performance. Hertz, J.Crew and Neiman Marcus all filed for bankruptcy as a result of the coronavirus pandemic.^[04] Back in 2018, Ford lost \$1.6 billion in revenue and was unable to produce 35,000 vehicles owing to a fire in one of their plants.^[05]

Additionally, a fragile supply chain often damages a company's brand reputation as customers express their displeasure.^[06] With the rise of social media and 24/7 news, there's a growing brand risk based on rapidly shared public opinion.^[02]

Unfortunately, disruptions cannot be avoided. Instead, companies must prepare to overcome challenges, which may mean rolling back some supply chain innovations of recent years, such as lean manufacturing, in order to develop long term resilience.

Figure 1: China is the world's manufacturing superpower
Top 10 countries by share of global manufacturing output in 2019*



*Output measured on a value-added basis in current U.S. dollars
Source: United Nations Statistics Division

Building supply chain resilience in your organization

Having a clear strategy to mitigate supply chain disruptions is the first step to developing the resilience that will satisfy customers and reduce the economic impact of events.

Going forward, this report will examine the reasons behind the increasing number of supply chain disruptions, with a feature section in Chapter 3 that explores the effects of COVID-19 on the world's supply capacity supported by Hubs platform data. The final chapter will discuss three primary approaches, listed below, to help strengthen your organization's supply chain:

1. Creating autonomy
2. Developing flexibility
3. Increasing visibility

These actions are designed to assist you in managing risk during the rising amount of supply chain disruptions. After all, it's not a matter of if your organization will experience disruption; it's only a matter of how often and for how long.

The rising risk

The growing number of supply chain disruptions over time

The rising risk

The growing number of supply chain disruptions over time

Supply chain volatility is not a new phenomenon, but it is occurring more frequently, affecting a range of different industries and regions due to an increasing array of threats. In parallel, supply chains have become more complex and brittle as a result of globalization.^[07] The more complex businesses become, the broader the spectrum of threats.

This chapter begins by discussing the level of damage and predictability associated with each type of disruptive event. It then continues by examining the increase of certain supply chain disruptions and their causes.

Not all disruptions are created equal

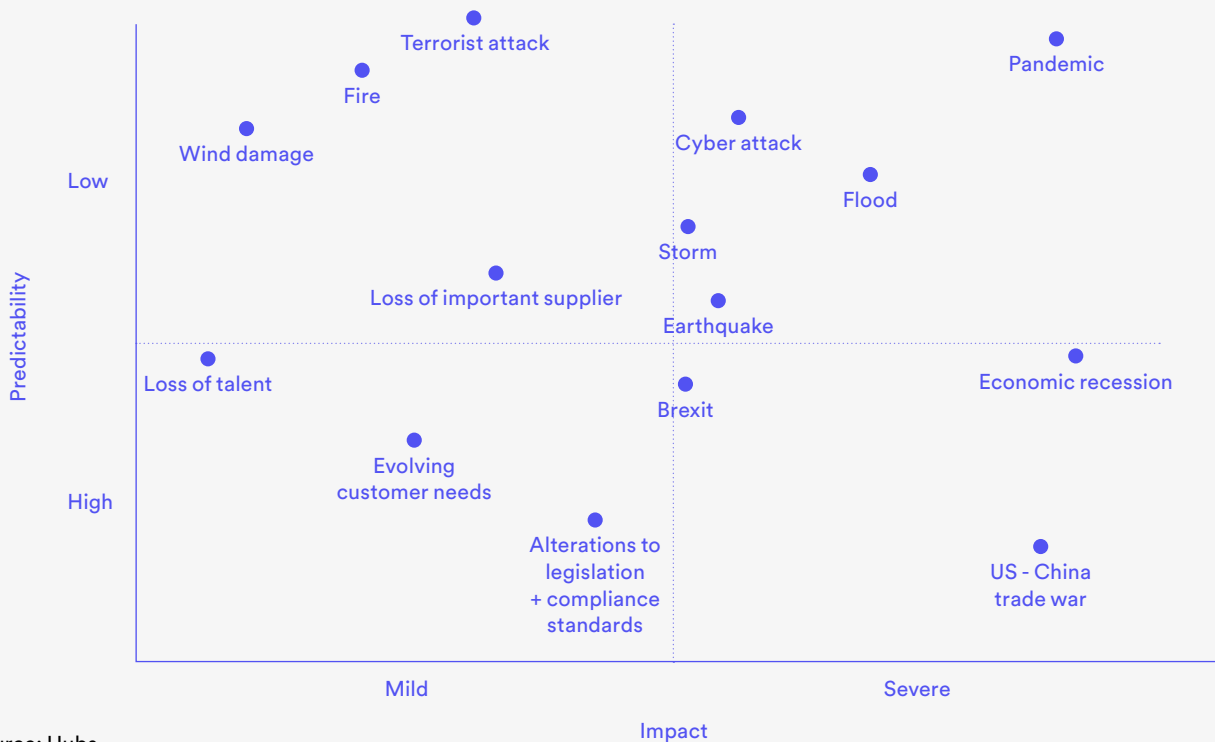
With the rising number of supply chain disruptions, it's common for businesses to focus their attention on events that are easier to anticipate and control. However, developing supply chain resilience will mean examining all variations of risk, and deciding to tackle each disruption type deliberately and strategically, rather than concentrating on the most predictable risk.

Generally, disruptions can be assessed on the basis of two factors: their predictability, as companies seek to plan long term, and how impactful they are, in terms of the magnitude of the disruption they cause to manufacturing supply chains. Figure 2 summarizes the most common and relevant disruptions that supply chains currently face, categorized by their level of predictability and impact.

A robust supply chain strategy should aim to mitigate disruption in each quadrant. The quadrant of Low Predictability paired with Severe Impact is one that is often ignored, as it is the hardest to anticipate which effects will be the consequence of these disruptions.

These disruptions, sometimes referred to as “unknown unknowns” or “Black Swans”^[04], are difficult to imagine occurring, let alone to develop a targeted strategy to reduce the effects. However it's clear, with the coronavirus pandemic being the harshest, most recent example, that these Black Swans demand sufficient attention to avoid the devastating aftermath. A resilient supply chain will allow your organization to better cope with a range of different disruptions, both known and unknown.

Figure 2: Supply chain disruptions categorized by level of predictability and impact



Source: Hubs

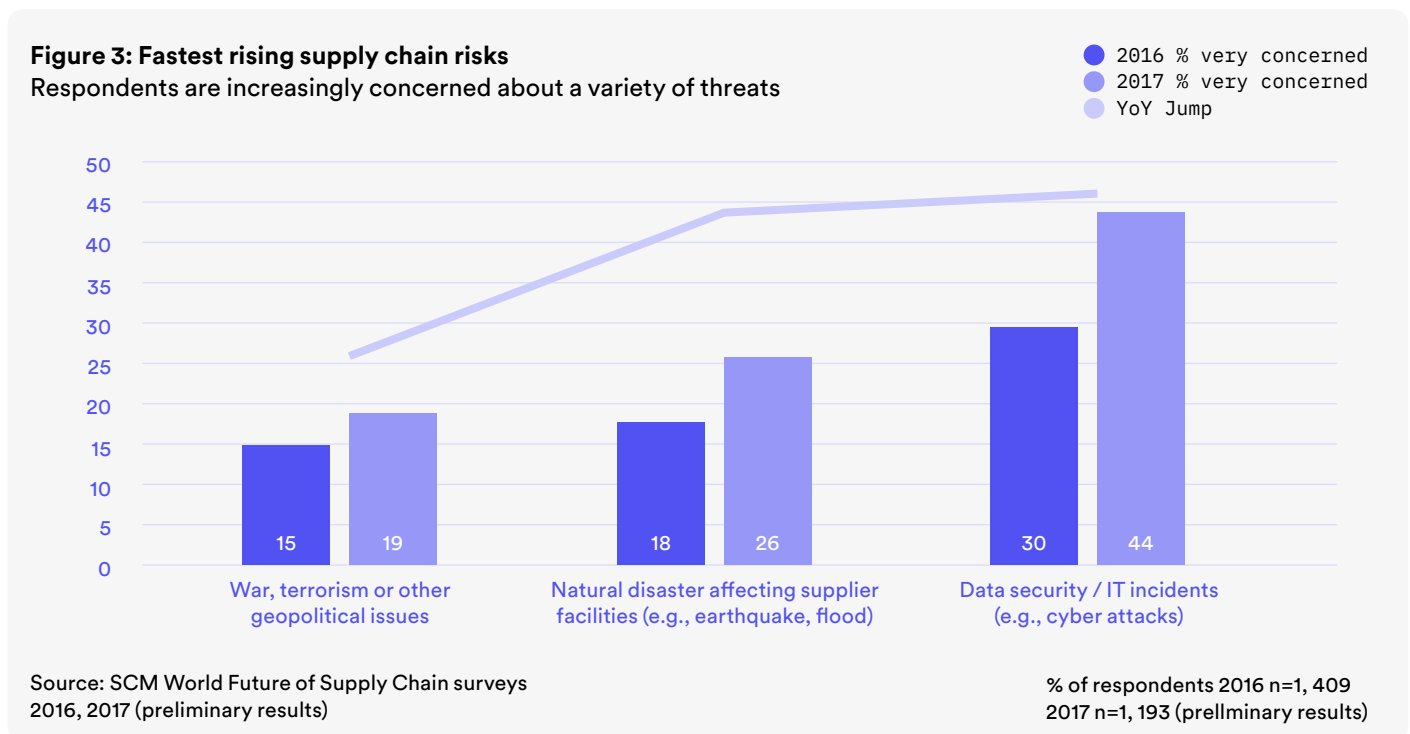
Top supply chain concerns

According to a Hubs survey conducted in October 2021 with 437 respondents, 75% of companies have experienced some form of external disruption to their supply chain over the past year. This survey built upon the 2020 supply chain resilience report that showed 72% of companies have experienced some form of external disruption to their supply chain over the last ten years, so concern is growing. In fact, 56% of respondents in our 2021 survey indicated that their supply chain disruptions have been worse this year than last year, citing material shortages as the main challenge.

In the past two years, companies have faced a dramatic escalation in trade tension and by sophisticated, large-scale cyber-attacks. At the same time, production and logistics operations survived a broad range of disruptive events, including natural disasters, material shortages, price hikes, industrial fires and explosions, production restrictions, labor disputes, port congestion, and cargo and warehouse theft.^[9]

Main concerns from the past 10 years

There have been three key categories that risk managers have reported to fear the most since 2016: natural disasters, geopolitical issues and cybersecurity, as we see reflected in Figure 3.



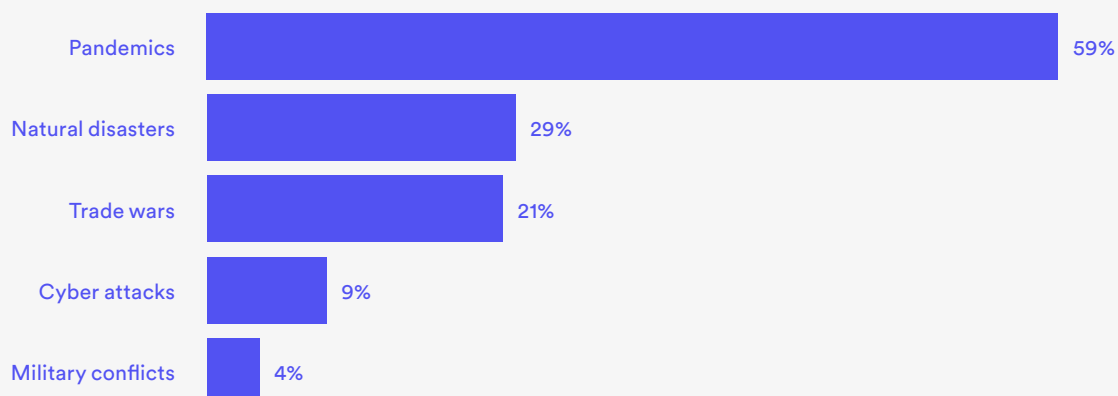
These concerns reflect the results of our 2020 survey that looked at the most common supply chain disruptions from the past 10 years, but there were some key differences.

72% of companies experienced some form of external disruption. Natural disasters and trade wars (i.e. geopolitical issues) were ranked in the top three most disruptive events, but the reality of cyberattacks disrupting businesses is disproportionate to the level of concern. A mere 9% of professionals actually experienced a cyberattack in the past ten years, despite 44% expressing their concern for data security or IT incidents in 2017.^[9]

The severest disruption over the past ten years was pandemics with 59% of businesses being impacted, presumably most extremely by the recent novel coronavirus. Chapter 3 has therefore been dedicated to examining the effects of the coronavirus pandemic on manufacturing supply.

Despite the actuality, pandemics did not even place in Gartner's rising supply chain risks.^[11] This should indicate to businesses not to focus on the specific potential threats and their effects on the supply chain. Rather it should push professionals to devote resources to building overall supply chain resilience in order to respond to and recover quickly from unanticipated disruptions, such as COVID-19.

Figure 4: Results from Hubs' 2020 survey
Top supply chain disruptions that have impacted businesses in the last 10 years



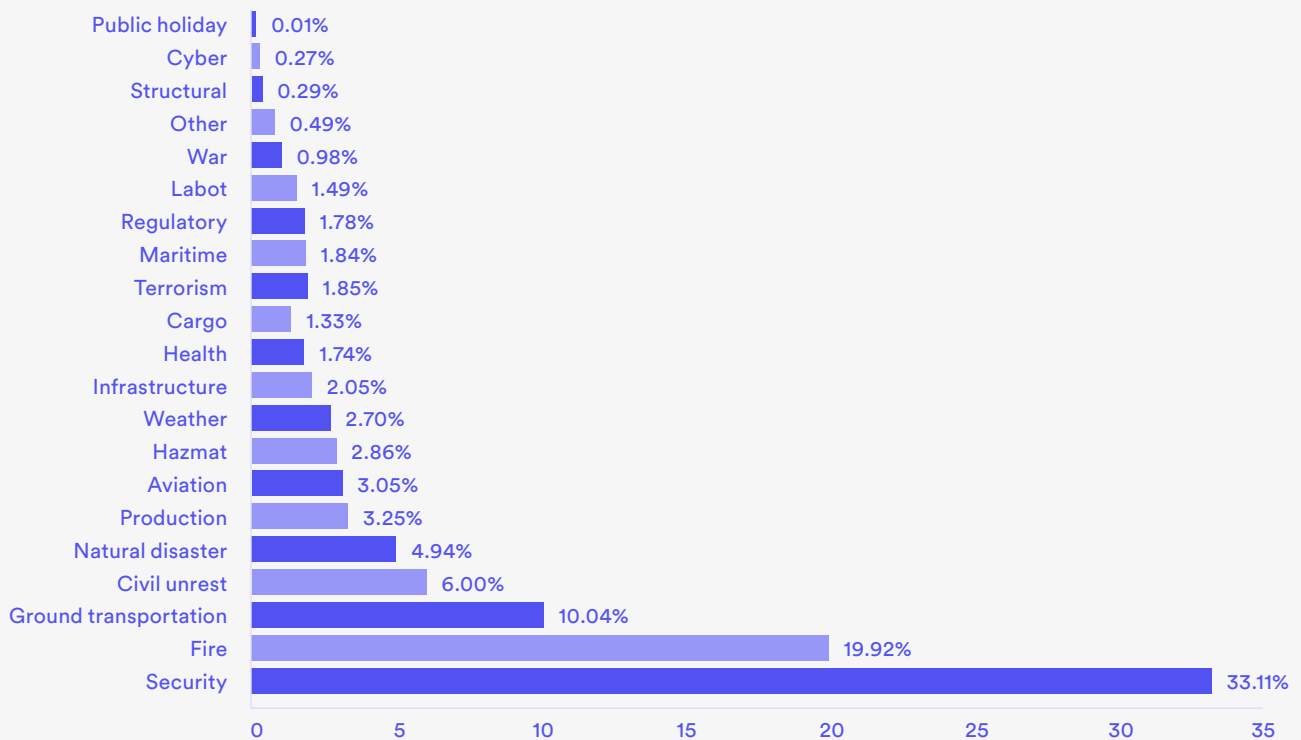
Q: Which supply chain disruptions have impacted your business in the last 10 years?
Source: Hubs survey, 1,281 participants, conducted June 2020

Current concerns

According to the annual risk report by Everstream Analytics (formerly Resilience 360), this past year has seen the bulk of disruption events broken into the following categories: public safety/security, fire and ground transportation, as we see reflected in Figure 5.

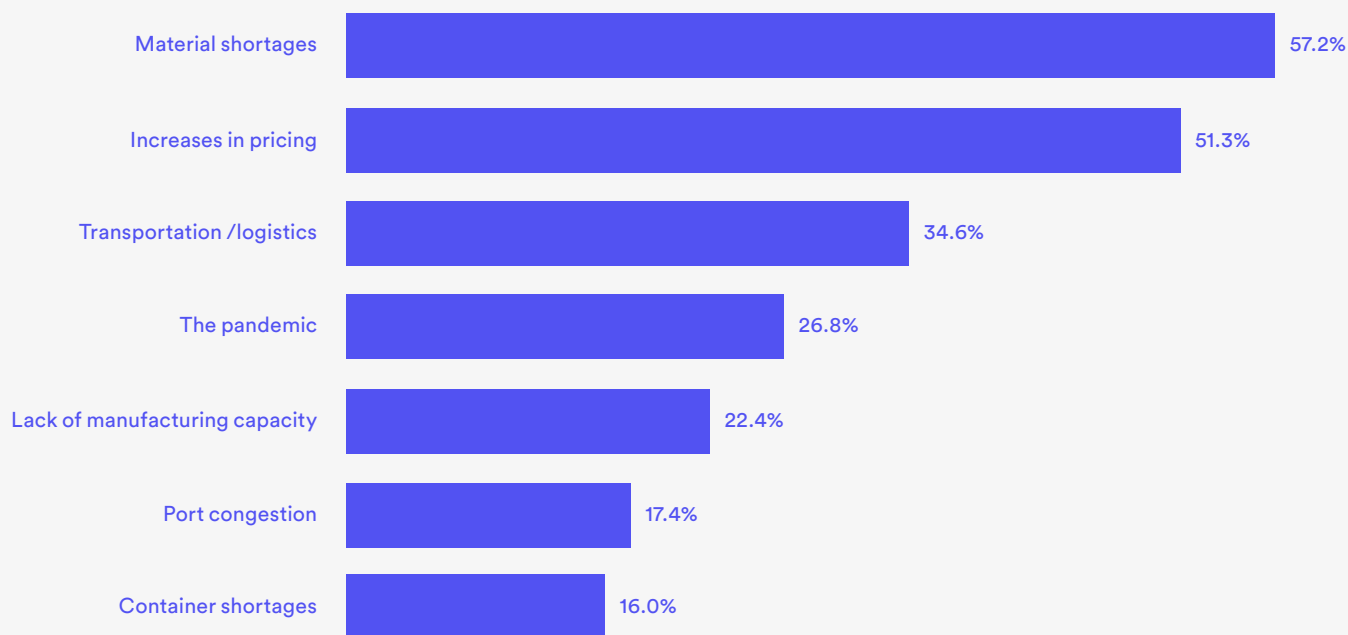
There is a disparity between reported incidence and the results of our survey, in Figure 6 below, which showed the majority of respondents experienced supply chain disruptions due to material shortages, increases in pricing and ground transportation/logistics.

Figure 5: Overall incidents by category (global)



Source: Annual Risk Report 2021. Everstream Analytics Annual Risk Report. March 2021.

Figure 6: Results from Hubs' 2021 survey
Top supply chain disruptions that have impacted businesses in 2021



Q: Which supply chain disruptions have impacted your business in 2021?
Source: Hubs survey, 437 participants, conducted October 2021

Key difference between the 2020 & 2021 survey

1. In 2020, 59.3% of people surveyed cited the pandemic as a supply chain concern, making it the top risk. In 2021, that number dropped to 26.8%, making it fourth on the lists.
2. New top concerns in the 2021 list include material shortages, increases in pricing, transportation/logistics, and lack of manufacturing capacity. The pandemic was the only issue in the top 5 concerns two years in a row. There was no other overlap.
3. In 2021, 56% of people surveyed felt that there were more supply chain disruptions this year than last.
4. 63% of respondents said they have taken measures to build up their supply chain resilience, up from 52% last year.

It is impossible to predict supply chain disruptions as the causes are constantly changing and will impact different industries in different ways. The following sections examine a range of disruptions that are a growing worry and the reasons behind their prevalence.

Geopolitical issues

Political events such as Brexit highlight the vulnerability of relying on only a few key suppliers in critical locations

Interest in politically driven trade conflicts connected to manufacturing, particularly in the US, has grown by almost 250% over the past 10 years.^[10] The interest from the US is driven by conflict with China, with tariffs and punitive responses leading to rising tensions and higher costs of goods. More than 60% of organizations have reported negative financial and/or operational consequences resulting from the US-China trade wars.^[11]

In response to geopolitical tensions with China, some organizations have sought new locations for production facilities, either re-shoring or relocation to other nations with less tariff exposure.^[12]

Brexit has also proved to be a geopolitical supply chain disruptor. In this case, the supply chain issues are due to several factors, primary of which are new import regulations between the EU and UK and a labor shortage, which if not caused by Brexit has been exacerbated by it. Fortunately, the worst-case scenario—a no-deal Brexit—did not materialize, meaning that new tariffs on imported or exported goods between the EU and UK have not been implemented. However, increased paperwork and customs checks have created hurdles for existing supply chains, exemplified by longer wait times for truck haulers at ports of entry, which inevitably leads to longer lead times for parts and products.

Labor shortages are another consequence of Brexit. In early 2021, for example, lengthy waiting and processing times for haulers at customs were in part due to a lack of trained customs agents. As many as 50,000 new customs agents were needed to process hundreds of millions of customs declarations.^[13] From another perspective, British manufacturers and importers are struggling to transport goods due to a lack of truck drivers. A survey by the Road Haulage Association found that there is a shortage of over 100,000 qualified truck drivers in the UK, which has created challenges for food and fuel shipments across the country.^[14] The shortage has been exacerbated by factors like Brexit and COVID-19. The pandemic, for example, created a backlog of truck driver tests, which stalled the influx of new drivers. On top of that, Brexit has narrowed the field of domestic workers. This has also contributed to severe labor shortages in British industries such as food processing.

Political events such as Brexit highlight the vulnerability of relying on only a few key suppliers in critical locations. Moving centralized production to a new location can be an expensive and lengthy endeavor and result in a similar risk at the new site.

Natural disasters

The mounting effects of climate change, from earthquakes to floods, tsunamis, hurricanes, volcanic eruptions and storms, are taking their toll on supply across the world. The number of natural disasters is rising year-over-year from 1980 to the present, according to research from McKinsey (see Figure 7).^[13]

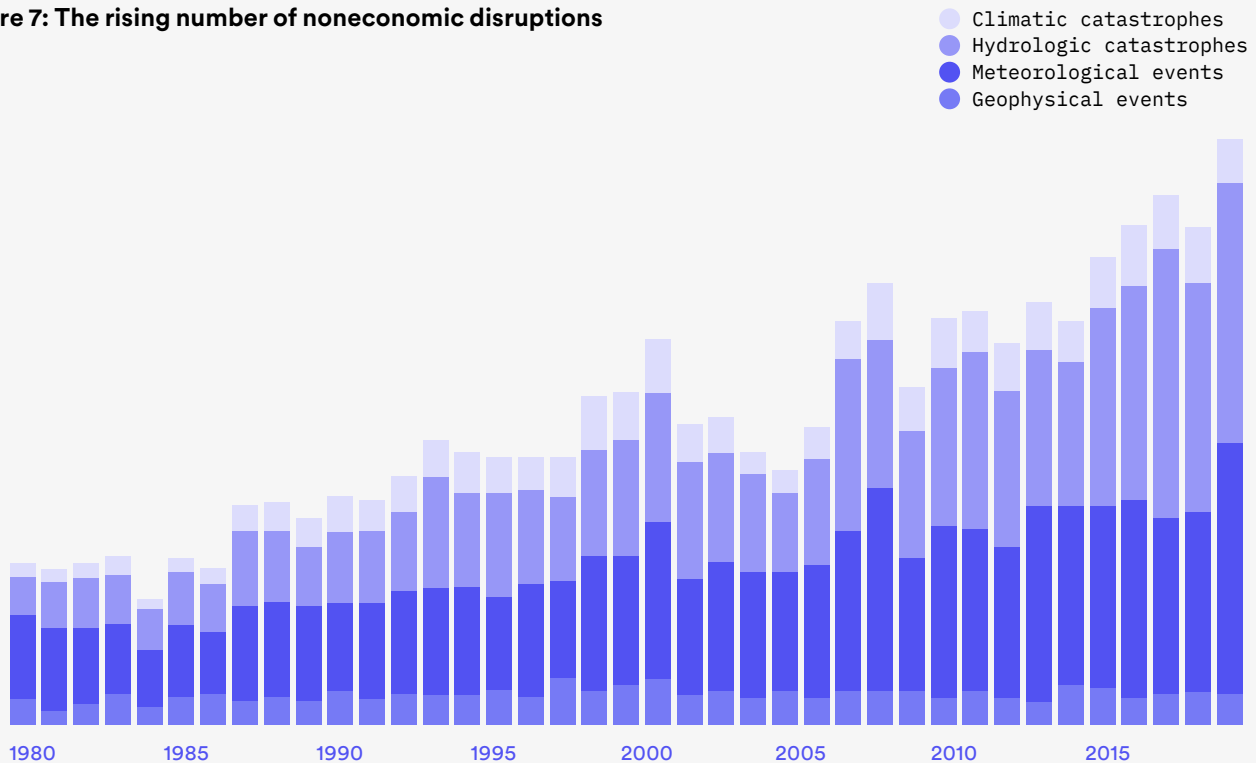
The effects of a hurricane, for example, can be long-lasting. Hurricane Harvey struck Texas and Louisiana in 2017, causing \$95 billion in damage with the average recovery time for an affected business at 17 weeks.^[13]

Japan's earthquake and tsunami in 2011 caused Toyota Motors a 99% drop in quarterly profits.^[15] While the eruption of Icelandic volcano Eyjafjallajokull in 2011 affected the production of 2,000 Nissan cars, and halted production at three of BMW's plants.^[16] The US alone experienced 265 weather and climate disaster events, each with more than \$1 billion in damages, between 1980 and 2020.^[17]

In 2021, floods in Germany and China slowed ground transportation and disrupted the transport of coal from mining regions, exacerbating China's energy crisis.^[18] In February, extreme cold in Texas and across the United States, along with the resulting power problems, also caused factories to shutter and transportation to halt.^[19] These events were reflected in \$42 billion in insured losses from natural disasters, hitting a 10-year high.^[20]

For organizations struck by natural disasters, the supply chain is disrupted in both directions, for consumers as well as producers of goods and services. Unfortunately, companies have no control over this aspect of their business, and can't anticipate relief from their governments.

Figure 7: The rising number of noneconomic disruptions



Source: McKinsey Agile Operations

Cybersecurity

\$13 million is the average cost of a cybercrime incident

It varies from company to company, but the rise of digital has meant cybersecurity is becoming a growing risk to the supply chain.

A number of companies have suffered ransom attacks or loss of data that has caused long-term operational and legal exposure. In addition to deliberate attacks by bad actors, technology is vulnerable to software glitches and telecommunications failures.

In 2019, 25% of companies experienced four or more cyberattacks in a year.^[21] In 2020, the percentage of businesses that reported attacks went down to 41%, but the cost of attacks has gone up, with the median cost of all cyber incidents in the US having risen from \$10,000 last year to \$50,000 in this year's figures. Due to extreme outliers, the average cost is far higher than the median, coming in at 13 million per incident.^[21] Overall, security breaches have risen 67% in the past five years, averaging 145 breaches per organization.^[22] Cybercriminals have moved past stealing information and are now targeting industrial control systems and other core systems. Holding technology assets for ransom is a growing trend.

Manufacturing and supply companies are on the front lines of cyberattacks due to increased digitization and connectivity. In 2019, a ransomware attack crippled industrial controls at manufacturers around the globe. Manufacturing companies are becoming favorite targets of advanced persistent threats. In 2019, Everstream Analytics (formerly Resilience360), recorded 290 cyber security incidents against supply chain companies. That number shot up by 216 percent increase in 2020, including threats like data breaches, ransomware and operational vulnerabilities.^[08]

Top Supply Chain Risks in 2021

In addition to the aforementioned supply chain risk categories, the past couple of years have brought to the fore a series of other risk areas, including sudden facility closures and mobility restrictions due to the pandemic (which will be explored in more detail in the next chapter), as well as logistics issues such as ongoing container shortages and the Suez Canal blockage, which brought global trade to a near standstill and cost the industry billions of dollars.^[23] Another supply chain risk that has the potential to influence the future of manufacturing and logistics is electricity shortages, such as those impacting regions of China and disrupting critical manufacturing facilities that businesses around the world rely on.

The past year has been marked by a number of challenges, including computer chip shortages, port congestion, the ongoing impacts of COVID-19, logistics impediments, and energy crises, though with every hurdle faced, solutions are being sought.^[24] What is becoming increasingly clear is that while certain risks are hard to anticipate and difficult to plan for, it is possible to mitigate the effects of supply chain disruptions by establishing a robust and agile supply chain.

It's critical to begin thinking about a risk-management framework to classify risks and to develop a supply chain that is by design flexible and adaptable. You can't think of disruption as a one-and-done event. The vulnerability in supply chains and the growing number of disruptions means businesses must start making their supply chains more resilient now.

COVID-19 spotlight

An extreme example of supply chain disruption

COVID-19 spotlight

An extreme example of supply chain disruption

COVID-19 provides an illuminating case study on the consequences of concentrated vs. distributed manufacturing

The COVID-19 pandemic has had a global impact and the financial repercussions are still unfolding. Nearly two thirds of companies have experienced disruption due to COVID-19, according to our survey, making it the most disruptive event to the supply chain in the last decade. Manufacturing was the top industry affected in terms of personnel, supply chain, revenue, and operations.^[25]

Because the coronavirus pandemic is one of the first examples where manufacturing capacity has been affected simultaneously worldwide, it's an illuminating case study on the consequences of concentrated vs. distributed manufacturing. The crisis highlighted the shortcomings of single-source manufacturing, whereby one sole vendor is selected to produce a component part, or sometimes an entire product. The prevalence of choke-points became very apparent as shutdowns rolled across the world and the manufacturing bases in a particular country became idle.

COVID-19 is a unique situation because it affects both supply and demand. Many companies faced immediate loss of supply when China began isolating in many parts of the country, with no alternatives. Labor shortages, lack of available inventory, and in some cases an excess of inventory, have challenged organizations' supply chains. Some industries with available inventory were able to ramp up to meet heightened demand, while others were unable to fulfill orders regardless of changes to pricing.

The next sections analyze supply and demand data collected through the Hubs platform to portray an overview of the real effects of COVID-19 on the manufacturing supply chain.

Global online manufacturing supply capacity

Figure 8 gives an overview of available global manufacturing capacity during the beginning of the coronavirus pandemic, based on sourcing data from Hubs' online manufacturing platform.

Since last year, supply capacity across Asia, Europe, and North America has been slightly more volatile year-to-date than 2021, fluctuating by 4.1% compared to last year's 3.9%. In 2020, Asia was more volatile in the first half of the year and evened out towards the end of the year. In 2021, this trend was reversed, which correlates with the coronavirus numbers in China and India, which were rising during the first half of 2020 and relatively level during the first few months of 2021. Overall, there have been more significantly more coronavirus cases in 2021 than 2020^[26], which may contribute to the increase in fluctuations. We can see the capacity drop as countries underwent lockdowns, leading to significantly reduced capacity.

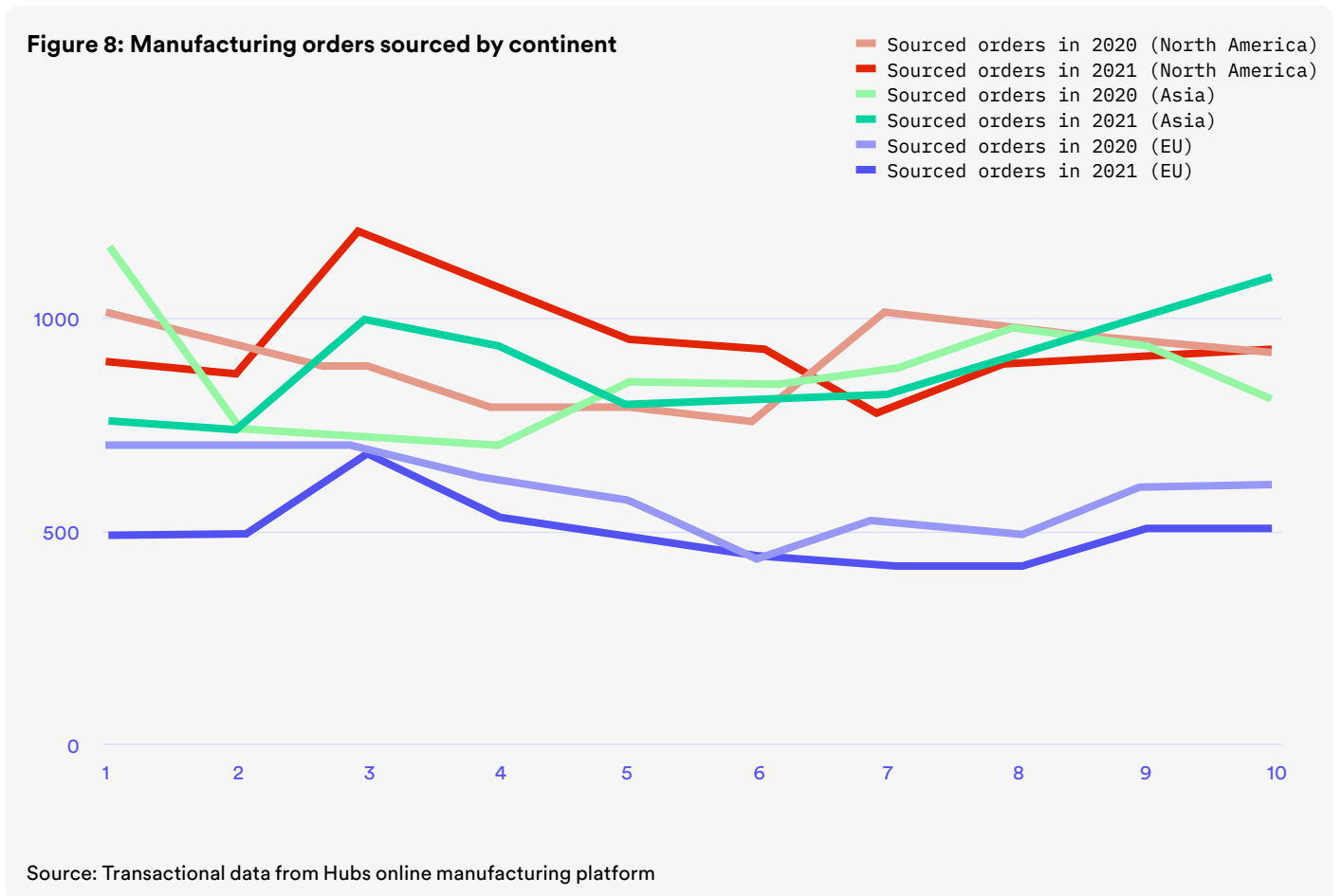
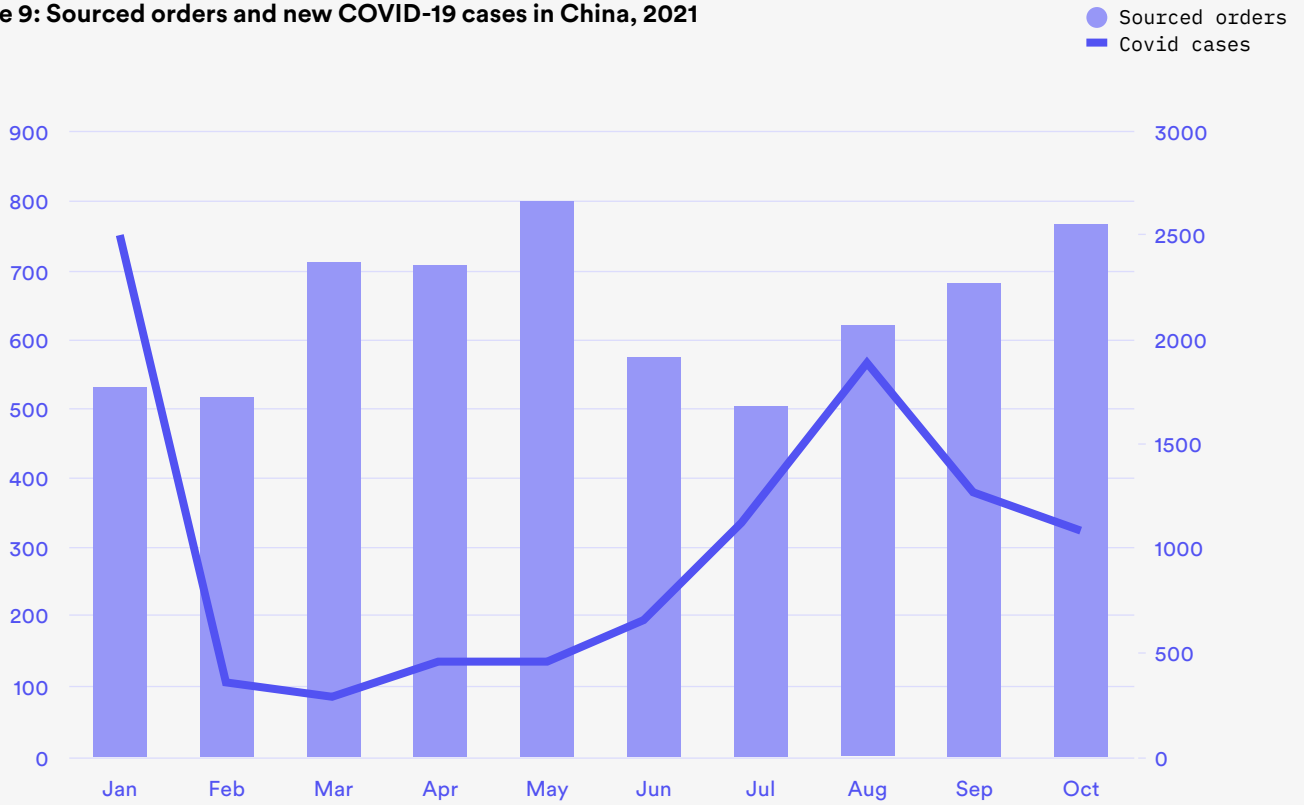
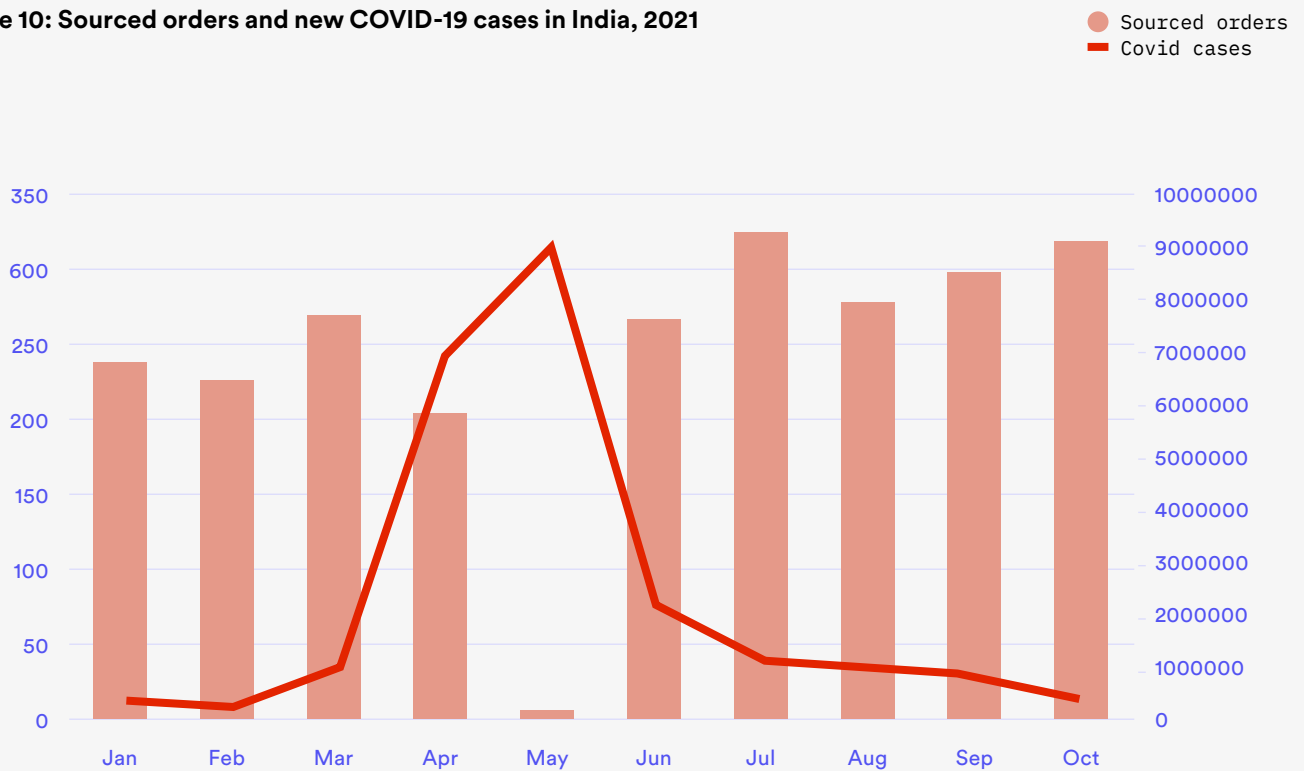


Figure 9: Sourced orders and new COVID-19 cases in China, 2021



Source: Hubs and [Our World in Data](#)

Figure 10: Sourced orders and new COVID-19 cases in India, 2021



Source: Hubs and [Our World in Data](#)

The direct impact of the pandemic becomes more apparent by comparing the number of COVID-19 cases against the number of orders that were sourced in India and China, shown in Figure 9 and 10. It's clear that as the number of coronavirus cases rose, the supply decreased significantly, and then recovered as the number of cases dropped.

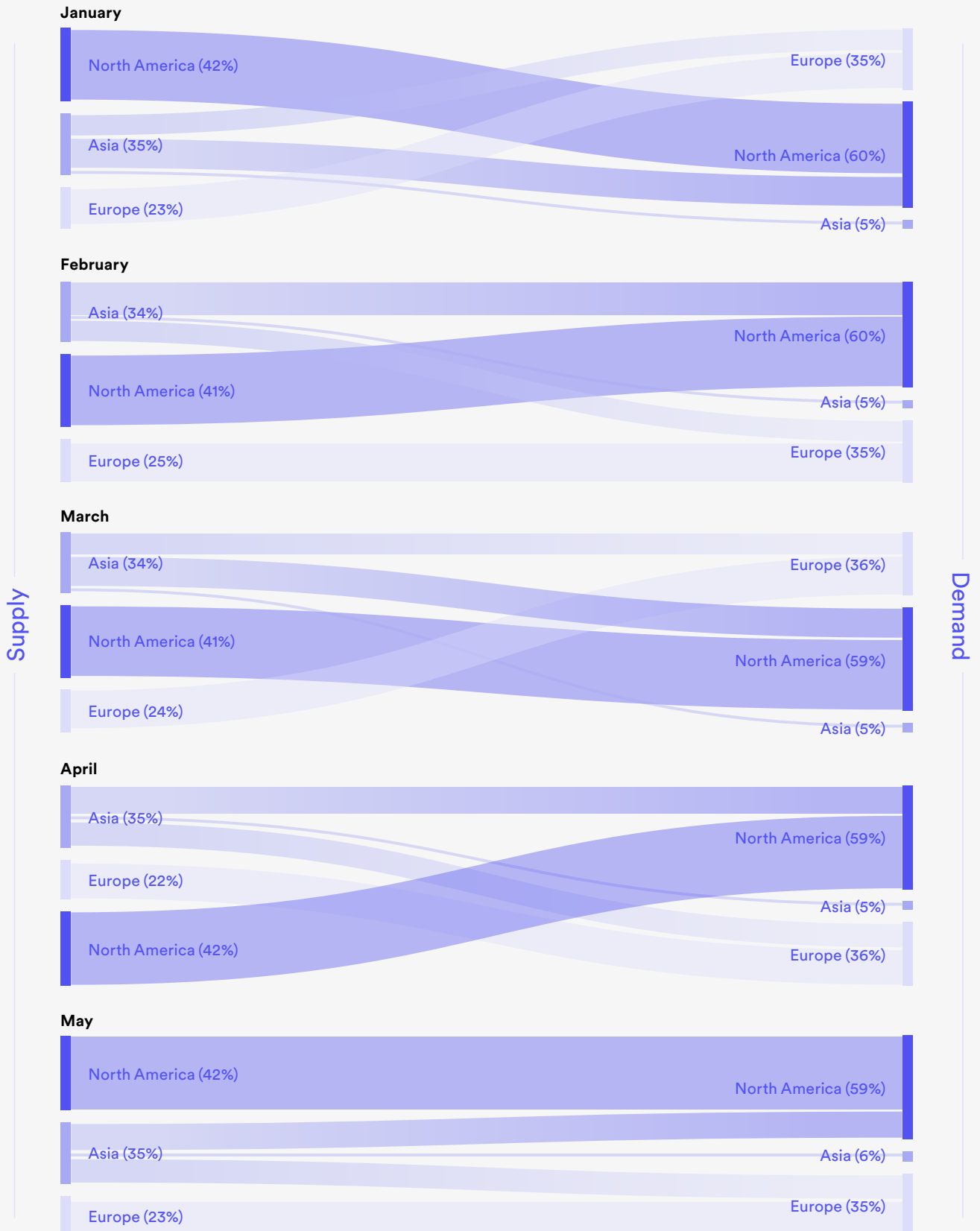
As the coronavirus outbreak spiked in India during April and May of 2021, supply capacity dropped off the chart. That is when manufacturing in China peaked, to compensate for India's lowered capacity. Then in July and August, as coronavirus cases escalated in China, we saw a boost in orders sourced in India.

As the global economy adjusts to ebb and flow of the pandemic, supply chain issues have evolved but have not gone away. Instead of triggered by full lockdowns, supply chain challenges are caused by a combination of intersecting elements, including different travel/mobility restrictions between nations as well as COVID-19 and vaccination protocols. A lack of international consensus on these topics continues to create hurdles for the mobility of transport workers.^[24] It is still unclear how this specific supply chain challenge will play out in the near future or how long term it will be.

The fluctuating supply and demand caused by the early pandemic has also had a discernible impact. This is exemplified when looking at the semiconductor industry. A severe shortage in semiconductors is having adverse effects on supply chains in the automotive and electronics industries, among others. One of the causes of this shortage is attributed to automotive manufacturers dramatically reducing semiconductor orders due to COVID-19 and a drop in car sales. When the demand for vehicles started to recover, semiconductor producers had already earmarked supplies for customers in other industries, leading to a shortage in automotive. Other factors, like geopolitical tensions between the U.S. and China, as well as fires at key production plants, have also led to a shortage in this area.^[27]

The flow of supply and demand

Figure 11: Supply vs. demand by continent



Source: Hubs

Figure 11: Supply vs. demand by continent



Source: Hubs

Supply capacity fluctuated per region, but globally suppliers could keep pace with demand

The Sankey diagrams in Figure 11 depict how supply and demand reflected manufacturing disruptions as the pandemic spread across the world.

During the first part of the year, we saw higher supply coming out of North America and Europe as winter coronavirus peaks began to level out. Meanwhile, supply was lower during that time frame in Asia, as coronavirus numbers were on the rise in two of the continent's biggest manufacturing hubs: India and China. Then between August and October, as cases dropped in Asia and began to rise in North America and Europe, we saw an increase in supply coming out of Asia and a dip in capacity in North America and Europe.

Throughout this entire period, supply capacity has fluctuated per region, but globally suppliers were able to keep pace with demand. Therefore, if an organization were to build out a network of suppliers distributed across the globe, there will always be supply (and demand to meet it) available. This distributed approach is the future of resilient manufacturing which offers reliable and scalable supply.

Building supply chain resilience

Effective measures organizations can take to mitigate disruption

Building supply chain resilience

Effective measures organizations can take to mitigate disruption

37% of companies have not taken any measures to build supply chain resilience

As we've seen with the simultaneously rising complexity of supply chains and the increasing number of disruptions, a clear strategy for building supply chain resilience to mitigate future disruptions will be essential for businesses moving forward.

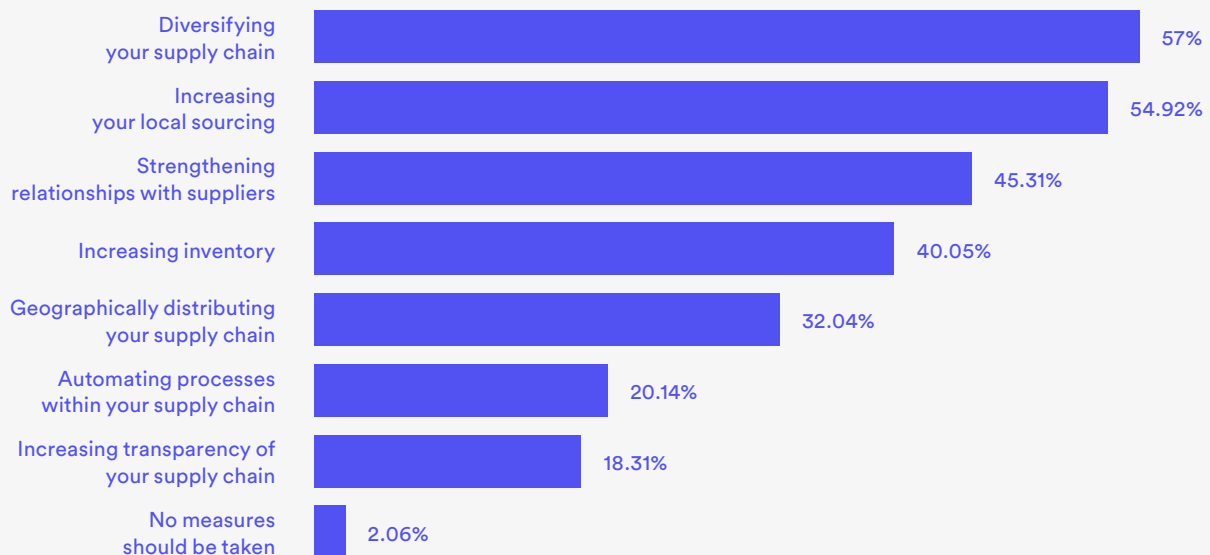
However, it seems that although organizations have coped with supply chain disruptions first-hand, a large proportion are unprepared. According to our 2021 survey, a surprising 37% of respondents have not taken any measures in the last year to build up supply chain resilience, despite 75% having experienced externally caused disruptions.

This chapter discusses the three approaches your organization can take to start building a resilient supply chain:

1. Creating autonomy (automation, additional inventory)
2. Developing flexibility (geographical diversification, agile working processes)
3. Increasing visibility (stronger supplier relationships, increased monitoring)

These approaches reflect the responses we received from the same survey mentioned above, where participants selected what they found to be the most effective measures to reduce disruptions in the future, shown in Figure 12.

Figure 12: The most effective measures to reducing supply disruptions in the future



Q: What measures do you believe would be most effective for reducing disruptions in the future?
Source: Hubs survey, 437 participants, October 2021

1. Creating autonomy

Supply chains that stretch across the globe are complex and inevitably subject to some level of disruption. But simplifying your supply chain where possible and reducing dependency on external parties will leave you less vulnerable to potential disruptive events. Practically, there are two key ways for reclaiming control of your supply chain: automation and buffer inventory.

Automation

Autonomy can be created through automation from both **an internal and an external perspective**.

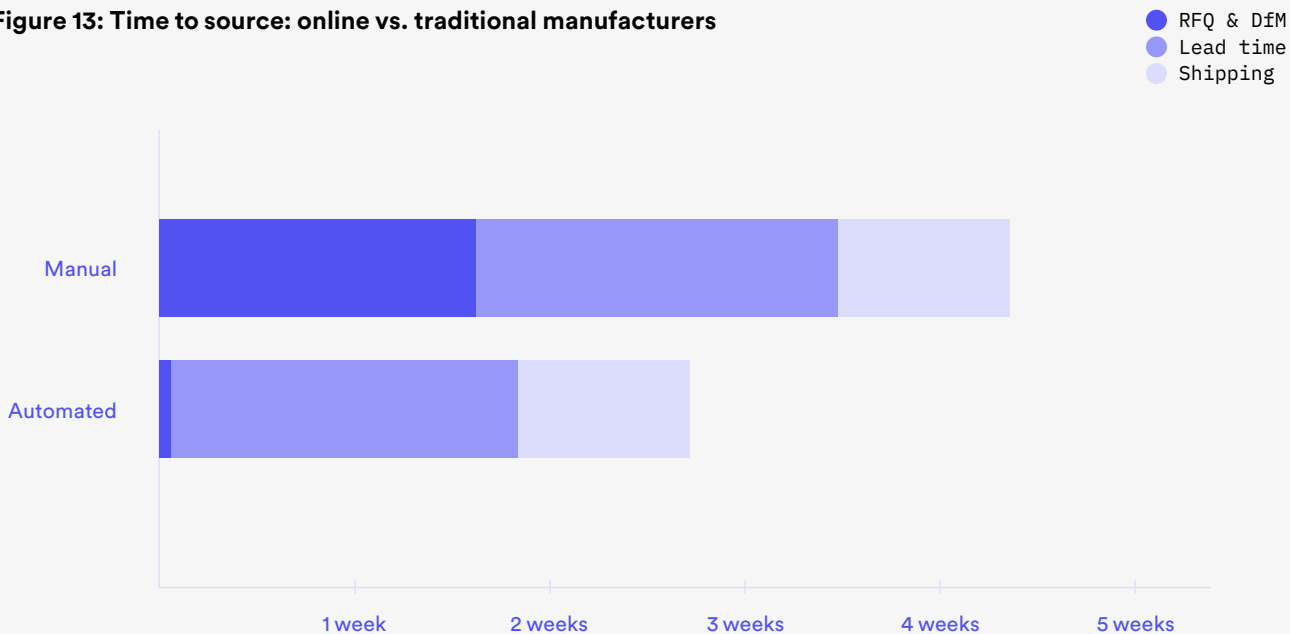
Internally, automation reduces your reliance on manual labor, which is particularly advantageous if production plants are forced to go into full lockdown — a case we saw occur during the beginning of the coronavirus. Today, many business activities can be automated using technologies such as robotic process automation (RPA), which can save companies significant time and resources.

In one study, the success of RPA adoption is shown to be widespread, with 41% of respondents saying the automation technology met their expectations and 35% stating it exceeded expectations.^[28] Gartner predicts that by 2024, businesses will be able to lower operational costs by 30% with the use of hyper-automation technologies and redesigned operational processes.^[29]

Externally, by reducing links in the supply chain and increasing the speed of outsourced production, companies have more manoeuvrability and can react and adapt more quickly to disruptive circumstances. If, for instance, the lead time for a certain part is 30 days, the parts in that order are stuck in production for the duration, and it can be a challenge to reroute to a different operational manufacturer or cancel an order. Additionally, speed in your supply chain leads to a faster recovery after the disruption.

For example, the quoting process, or RFQ and DFM process, for outsourced manufactured parts, can be reduced to seconds, rather than the traditional manual part quoting process, which can take anywhere from days to weeks. There are now platforms, like Hubs, that scan CAD files and give you a quote in a few seconds, allowing companies to radically cut down on pre-production time and receive parts 45% faster than traditional methods (see Figure 13).

Figure 13: Time to source: online vs. traditional manufacturers



Source: Hubs

Volkswagen automating Zickau plant to produce up to 330K electric cars per year

Since 2018, the Volkswagen Group has been investing heavily in automation to become the largest and most efficient electric car plant in Europe. The cockpit assembly is now fully automatic and a robot automatically installs the rear and front axles on the chassis frame. Automation has also been incorporated in other areas of the plant, aside from assembly, to automatically inspect the surfaces after final assembly and to deliver and unload the batteries for the electric vehicles.

In the future, the Volkswagen Group is looking to automate other processes like the fine tuning of the chassis in the car, and the sorting of finished pressed components with computer vision. This investment in automation means the Volkswagen Group is able to accelerate their processes and rely less heavily on manual labour in order to produce up to 330,000 electric cars per year from 2022.^[30]

Additional inventory

By creating redundancy at various points in your supply chain, you can buy yourself extra time once a disruption hits. In the best case scenario, you'll have enough inventory to continue operations during the disruption. Otherwise, you'll at least have more time to prepare a thorough contingency plan.

This approach is especially valuable for critical parts, where it may be more difficult to switch suppliers quickly. Although effective, this solution is costly, as you'll need to pay for storage and non-revenue generating stock.

[Learn more about how supply chain inventory buffers can mitigate risk in this article](#) 

2. Developing flexibility

As Elon Musk has put it, “It’s OK to have your eggs in one basket as long as you control what happens to that basket.” The issue in manufacturing is that the supply chain is so complex and contains so many moving pieces, you will never control the basket and will never become completely self-reliant.

Therefore, a key factor in supply chain resilience is planning for disruptions by spreading your risk. While you may not have a specific plan in place, you can strategize a response when key external suppliers are not able to meet their commitments. These approaches to developing flexibility are discussed below.

Make it easy to shift production between facilities

Diversifying your supply chain is the best way to reduce the impact of disruptions

Don’t rely on a select number of suppliers, or even on a certain geography where all your suppliers are based. As we’ve seen during the height of the coronavirus pandemic, entire countries or regions can be affected by disruption with zero supply capacity.

Instead, focus on diversifying your supply. Build a quality-vetted, geographically distributed network of engaged suppliers that you can rely on to take on more capacity when needed.

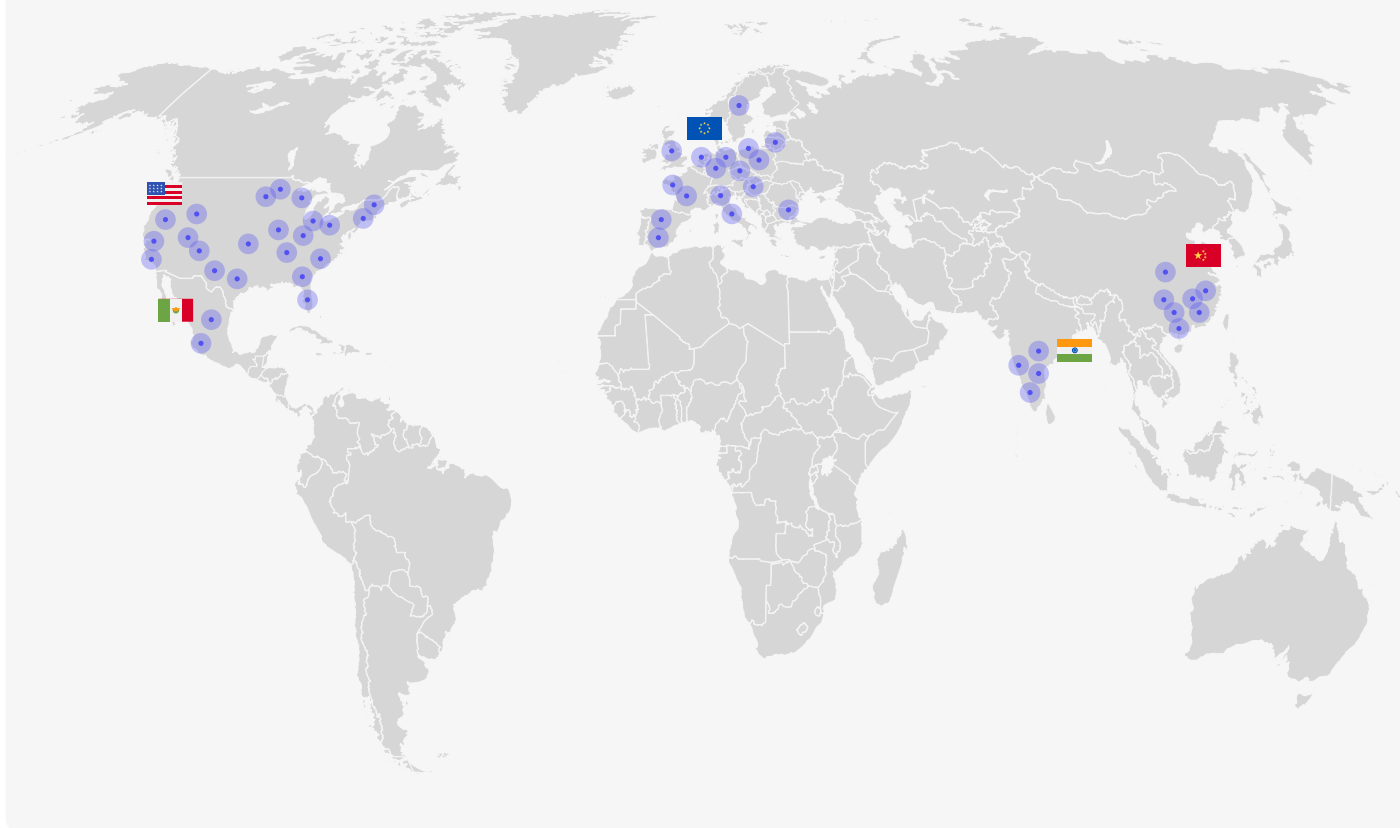
Diversifying your supply chain was voted the number one measure to reducing the impact of future disruptions (see Figure 12), which is understandable given the effectiveness of a distributed network during the beginning of the coronavirus pandemic.

As we saw in Chapter 3, when China went into lockdown at the beginning of 2020, the majority of manufacturing orders shifted to India, and some to Europe. In May of 2021, when India entered into full lockdown, cutting off supply completely, China was able to compensate for India’s reduced capacity.

Despite entire regions being in total lockdown during the pandemic, supply capacity has remained available across the world, further highlighting the strengths in building a distributed network of suppliers. Ongoing risks, such as power crises, labor shortages, and natural disasters reinforce this idea. These disruptions may upend certain industries and geographical markets, but an adaptable supply chain that is not solely reliant on a single supplier or region will be able to withstand them.

As an alternative to diversifying your supply chain yourself, which is a time-consuming and complex process, you can rely on specialized manufacturing platforms, such as Hubs, to provide you with instant access to a distributed network of hundreds of quality-vetted suppliers.

Hubs' distributed manufacturing network is made up of 240+ suppliers, spread across 4 continents



Encourage agility in your internal working processes

There are many techniques to making a business more adaptable to change. These include working in an agile process, completing tasks simultaneously instead of sequentially. With this way of working, you can easily reallocate resources where needed, adapt unfinished products to meet demand, and iterate on product design faster.

Reallocating your resources not only includes adapting parts or unfinished products, but also cross-training employees, who are then able to help fulfill demand in areas of the business that are not entirely their own. Research shows that even training plants to make as little as two different products can achieve extremely high levels of flexibility.^[04]

GE using agile to launch new products in months rather than 5 years

GE Appliances started incorporating an agile manufacturing approach called FastWorks in 2013, which involves working closely with customers to get direct feedback throughout the design process. The first product to test this agile methodology was a refrigerator with french doors. A small team, with half the budget, were tasked to redesign every part in the refrigerator, and to have a working product ready in three months and in production in less than twelve months.

Rather than the previous approach of letting the sales team guide the specifications of the product and then launch it, the product design team communicated directly with customers at every stage of the design iteration process.

In less than a month, they presented the first version to customers who shared their (negative) feedback. Taking on their comments, the product design team managed to produce a new iteration to discuss with customers on average every month. This was a radical change compared to the previous secretive process where nothing was revealed until the public release every five years. The agile way of working paid off with the normal rate of sales doubling. GE Appliances developed stronger relationships with their customers and were able to adapt fast to shifting demand - two key advantages in overcoming supply chain disruptions.^[31]

3. Increasing visibility

For areas of the business where you cannot control or react fast enough (no matter how flexible you are), another option is to increase visibility over your supply chain in order to spot oncoming disruptions faster and therefore give yourself more time to react. Methods for increasing your visibility are explained below.

Monitor your whole supply chain

A lot of companies only monitor tier one or two suppliers, but this doesn't paint the whole picture. Delays caused by deeper tier suppliers, or even a lack of raw materials, can cause disruption throughout your entire supply chain. By closely monitoring suppliers across all tiers, you'll be able to spot any warning signs well before the consequences of a disruption take effect.

However, monitoring your supply chain from the raw materials to the finished product can be a complex and lengthy process. This may explain why this approach was the least popular according to our survey, with 18.3% of respondents selecting increasing transparency in the supply chain as an effective measure to reduce the effects of supply disruptions.

Thankfully, the complicated monitoring process has become a lot easier thanks to supply chain monitoring software. This type of software generally comes with these features to automate much of the manual monitoring and calculations required to have an overview of supply chain risk:

- **Supply chain mapping**
to monitor not only tier one and tier two suppliers, but the entire supply chain
- **24/7 supplier monitoring**
which alerts you to disruptions that may affect your suppliers
- **Risk calculation of disruptive events**
with the potential revenue lost

[Learn about 4 tools to help monitor your supply chain](#) 

Build deeper relationships with suppliers

Gaining knowledge of possible oncoming disruptions can not only be achieved through monitoring suppliers for performance and compliance, but also by developing deeper relationships with a select group of suppliers.

By developing a close relationship by forewarning the suppliers of any changes in demand or order changes, and perhaps involving them in some product decisions, you'll receive earlier updates and alerts of future disruptions further down the supply chain in return.

Getting to the top of Indian supplier's priority list during COVID-19

While production in China and other parts of the world had stalled due to the coronavirus pandemic, Hubs' manufacturing partners in India prioritized customer orders from Hubs over their other customers. This was largely due to the strong relationship the Hubs supply team has built with all of their suppliers prior to the outbreak.

After following a rigorous quality audit and onboarding procedure, Hubs suppliers receive a daily check in as well as regular on-the-ground visits. But the strength of the relationship does not come from a traditional one-way customer-supplier relationship, but rather a two-way partnership. For instance, if the supplier has difficulty producing the part or understanding the customers' design requirements, Hubs will work together

with the supplier to fix or improve those issues and processes.

Similarly, Hubs returned the favor by prioritizing certain suppliers that were hit the hardest by the coronavirus pandemic. During COVID-19, many suppliers lost orders from the motionless aerospace industry. To help these struggling suppliers fill the loss of orders, Hubs offered an increased number of orders to these manufacturers.

Building this deep relationship doesn't only come from monitoring or frequent communication, but a partnership where both supplier and customer prioritize the other in times of need, which can benefit both parties during a disruptive event.

Conclusion

Creating autonomy, developing flexibility and increasing visibility across your supply chain will help your organization to reduce the number of vulnerabilities in the supply chain, spot upcoming disruptions, and mitigate the effects of disruptions when they inevitably do occur. These three approaches will not only strengthen the company in the face of oncoming disruptions, but also serve the company in calmer times.

The number and the type of disruption is out of your control. Resilience is not. Making the deliberate choice to develop a long-term strategy to overcome disruption, whatever its effects is the only option. Those who don't pursue resilience become ever more vulnerable in the face of the rising number of supply disruptions, and their wider reaching consequences, to come.

About this report

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About Hubs

[Hubs](#) is an online manufacturing platform that provides engineers with on-demand access to a global network of manufacturing partners. Users can easily upload their design, instantly receive a quote, and start production at the click of a button.

Founded in Amsterdam in 2013, Hubs was acquired by Protolabs in January 2021. To date, Hubs has produced more than 7 million parts, using various manufacturing technologies, including [CNC machining](#), [3D printing](#), [injection molding](#) and [sheet metal fabrication](#).

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References

- [01] [Building a Resilient Supply Chain](#)
Harvard Business Review, August 14, 2007.
- [02] Sheffi, Yossi. [The Power of Resilience](#)
MIT Press, 2015.
- [03] [Coronavirus Is Proving We Need More Resilient Supply Chains](#)
Harvard Business Review, March 2020.
- [04] [Coronavirus Bankruptcy Tracker: These Major Companies Are Failing Amid The Shutdown](#) Forbes, May 3, 2020.
- [05] [Ford's Risk Management Lessons](#)
Industry Week, May 29, 2018.
- [06] [Building Resilience In Complex International Supply Chains](#) FM Global, Feb. 12, 2020.
- [07] [The Evolution of Resilience in Supply Chain Management: A Retrospective on Ensuring Supply Chain Resilience](#)
Journal of Business Logistics, March 2019.
- [08] [Annual Risk Report 2021](#)
Everstream Analytics Annual Risk Report. March 2021.
- [09] [Supply Chain Risk 2020: New Worries](#)
SCM World Future of Supply Chain surveys. October 2017.
- [10] [Trade War Manufacturing](#)
Google Trends.
- [11] [Future of Supply Chain: Reshaping the Profession](#). Gartner, November 2019.
- [12] [Supply chain risk management is back](#).
McKinsey&Company Jan. 28, 2020.
- [13] [Stuck in Kent: How Brexit Red Tape Choked Cross-Border Trade](#).
Bloomberg, January 15, 2021.
- [14] [How serious is the shortage of lorry drivers?](#) BBC, October 15, 2021.
- [15] [Toyota profits plunge after earthquake disruption](#) BBC, August 2, 2011.
- [16] [Nissan and BMW car production hit by volcano disruption](#)
The Guardian, April 20, 2010.
- [17] [Billion-Dollar Weather and Climate Disasters](#) NOAA.
- [18] [Global supply chains buckle as virus variants and disaster strike](#).
Reuters. July 23, 2021.
- [19] [Sever winter weather in Texas will impact many supply chains beyond chips](#).
Forbes. Feb 19. 2021
- [20] [Natural disaster H1 insured losses hit 10-year high-Aon](#). Reuters. July 21, 2021.
- [21] [2020 Cyber Readiness Report](#), Hiscox.
- [22] [Ninth Annual Cost of Cybercrime Study](#)
Accenture, March 6, 2019.
- [23] [The cost of the Suez Canal blockage](#).
BBC, March 29, 2021.
- [24] [The global supply chain nightmare is about to get worse](#). CNN, October 2021.
- [25] [Coronavirus impact by Industry](#)
Statistica.
- [26] [An interactive web-based dashboard to track COVID-19 in real time](#). The Lancet. February 2020. Published online at OurWorldInData.org. Retrieved from: 'https://ourworldindata.org/covid-cases'.
- [27] [Why We're in the Midst of a Global Semiconductor Shortage](#).
Harvard Business Review, February 26, 2021.
- [28] [Deloitte's second biennial global cost survey](#). Deloitte, April 2019.
- [29] [Gartner Forecasts Worldwide Hyperautomation-Enabling Software Market to Reach Nearly \\$600 Billion by 2022](#).
Gartner, April 28, 2021.
- [30] [High-tech in production](#)
Volkswagen, June 11, 2019.
- [31] [How GE Applies Lean Startup Practices](#)
Harvard Business Review, April 23, 2014.



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