



# Supply chain resilience report 2023

Industry trends and supply chain strategy  
for manufacturing

# Report highlights

# 43.7%

of respondents think increasing local sourcing will help strengthen supply chains in 2023

---

# 45.3%

of companies had their supply chains impacted by the war in Ukraine

---

# 49.4%

of companies faced raw material shortages more often than in 2021

---

# 76.6%

of companies experienced externally caused disruptions to their supply chain in 2022, with material shortages being the biggest challenge

---

# 55%

of survey respondents showed concern about the effects of rising energy costs on their business

---

# 70.1%

of companies took measures in 2022 to build up supply chain resilience

---

# 49%

of respondents are concerned about the rising tensions between China and Taiwan

---

# Table of contents

|                                                                   |    |
|-------------------------------------------------------------------|----|
| <b>Introduction:</b>                                              |    |
| <b>Supply chain resilience – what it means and why it matters</b> | 5  |
| <hr/>                                                             |    |
| Defining supply chain resilience                                  | 5  |
| The rising need for resilience                                    | 6  |
| Building supply chain resilience in your organization             | 7  |
| <br>                                                              |    |
| <b>The rising risk:</b>                                           |    |
| <b>The growth of supply chain disruptions</b>                     | 9  |
| <hr/>                                                             |    |
| Not all disruptions are created equal                             | 10 |
| Top supply chain concerns                                         | 11 |
| Five supply chains risks to watch out for in 2023                 | 16 |
| Six industries that will face supply chain disruptions in 2023    | 17 |
| Global online manufacturing supply capacity                       | 18 |
| <br>                                                              |    |
| <b>Building supply chain resilience:</b>                          |    |
| <b>Five solutions for strengthening supply chains in 2023</b>     | 20 |
| <hr/>                                                             |    |
| 1. Automation                                                     | 21 |
| 2. Reserve inventory                                              | 23 |
| 3. Geographical diversification                                   | 24 |
| 4. Agile internal processes                                       | 25 |
| 5. Supply chain monitoring                                        | 26 |
| Conclusion                                                        | 27 |
| <br>                                                              |    |
| <b>About this report</b>                                          | 28 |
| <hr/>                                                             |    |
| <br>                                                              |    |
| <b>References</b>                                                 | 29 |
| <hr/>                                                             |    |

# Introduction

---

## Supply chain resilience – what it means and why it matters

# Introduction

## Supply chain resilience – what it means and why it matters

Supply networks drive the world's economies. Not only that, we are dependent on global supply chains for access to everything from food, to medical equipment, to energy. This is why it is more important than ever for organizations to shore up their supply chains and make them more resilient to both predictable and unpredictable disruptions.

Traditionally, profit incentives have favored lean manufacturing models, or just-in-time manufacturing (JIT). While this approach has proven to reduce costs in the short term and boost efficiency, its vulnerabilities have become increasingly evident in the face of global crises, such as the pandemic and war in Ukraine. Where lean supply chains fail, resilient supply chains can adapt, ultimately decreasing the impacts of disruptions and keeping things up and running.

## Defining supply chain resilience

A resilient supply chain is prepared for unforeseen disruptions, able to react and recover fast, 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 deal with and even benefit from disruptions.<sup>[01]</sup>

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.

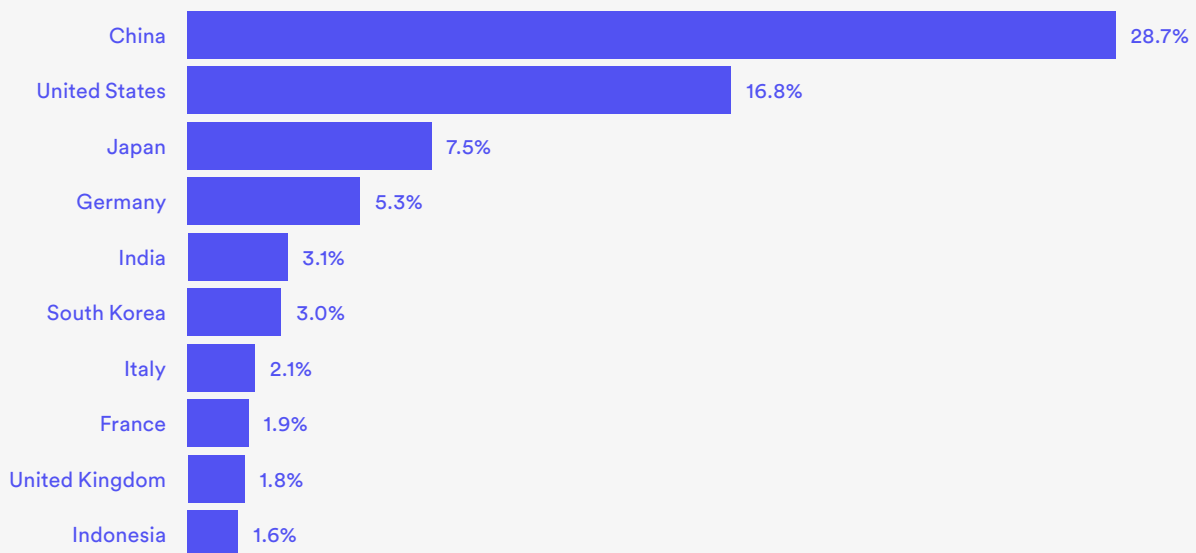
# The rising need for resilience

Supply chain resilience has always been important and necessary in a world driven by global trade, but the need for it has been magnified in recent years by a combination of public health, environmental, and geopolitical concerns. The COVID-19 pandemic showed us how fragile global trade networks and supply chains were in 2020, causing massive disruptions and shortages across various industries as cities locked down and the supply of labor was dramatically impacted.

Today, some of the most pressing stresses on supply chains can be traced to geopolitical events, particularly the ongoing war in Ukraine and escalating tensions between China and Taiwan. These conflicts pose serious threats to global supply chains due to trade route blockades, economic sanctions, and raw material shortages. Already, we are seeing the early ramifications of trade sanctions with Russia with an energy crisis across Europe. Fuel shortages caused by growing demand in the region are driving up costs. In emerging markets particularly, manufacturing facilities and factories are at risk of increased blackouts<sup>[02]</sup>, and the higher cost of transport will drive up the cost of commodities.

Other supply chain risks, such as natural disasters, cyberattacks, labor shortages, and inflation, continue to be a concern, further emphasizing the need to think about and plan for a more resilient supply chain. Going by our latest survey, 70% of respondents have implemented measures in the past year to improve supply chain resilience, which — while a majority — still leaves many companies more vulnerable to disruptions.

**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

In 2022, businesses small and large succumbed to supply chain troubles. A series of disruptions — including a fire, the pandemic, and a winter storm — led Texas petrochemical producer TCP Group to file for bankruptcy.<sup>[03]</sup> Logistics challenges, labor shortages, and rising cost of ingredients forced cosmetics company Revlon to file for Chapter 11 bankruptcy.<sup>[04]</sup> And shortages in wire harnesses, previously manufactured in Ukraine, have led to slowdowns in European automotive production.<sup>[05]</sup>

There are ample long-term benefits to pursuing a resilient supply chain in lieu of more short-term lean manufacturing. A resilient supply chain anticipates disruptions and mitigates the effects of both predictable and unpredictable events through a combination of strategies. Diverse supply networks, robust cybersecurity, and automated processes are just some of the steps organizations can take to reinforce their supply chain and ensure reliable performance over the long term.

# Building supply chain resilience in your organization

Developing a clear strategy is a crucial step in mitigating supply chain disruptions. This report will examine the reasons behind the growing number of supply chain disruptions and discuss approaches for strengthening your organization's supply chain. The final chapter will provide a detailed analysis of these approaches and their potential benefits.

1. Automation
2. Reserve inventory
3. Geographical diversification
4. Agile internal processes
5. Supply chain monitoring

These actions are designed to help you manage risk during the increasing number of supply chain disruptions. After all, it's not a matter of whether your organization will experience disruption, but rather how often and for how long.

# The rising risk

---

## The growing number of supply chain disruptions over time



# The rising risk

## The growth of supply chain disruptions

Supply chains have become more complex and brittle as a result of globalization.<sup>[06]</sup> The more complex businesses become, the broader the spectrum of threats. This increased complexity has exposed them to a wider range of threats. In this section, we will explore the level of damage and predictability associated with different types of disruptive events. We will then look at how some supply chain disruptions have become more common, and examine the causes of this increase.



Pamplona, Spain March, 2022, truck strike blocking traffic in protest of high fuel price

# Not all disruptions are created equal

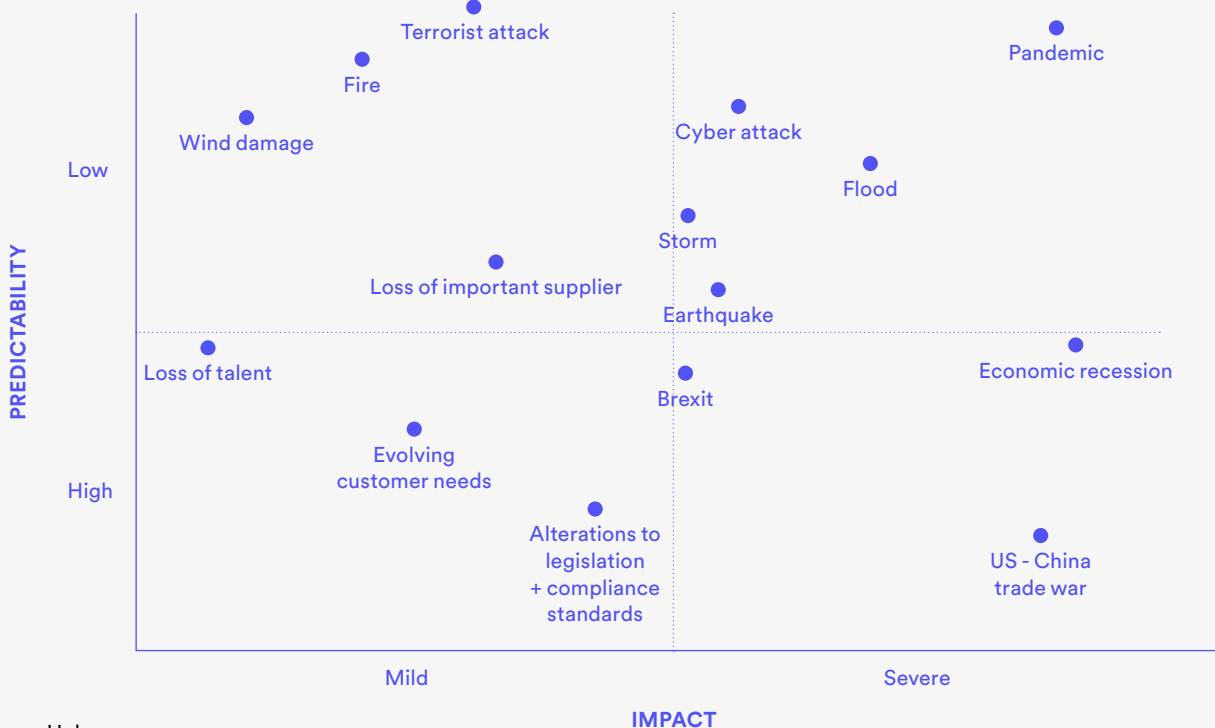
With the rising number of supply chain disruptions, it's common for businesses to focus their attention on events that are easier to anticipate and control. However, developing supply chain resilience involves examining all variations of risk and tackling each disruption type deliberately and strategically, 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 currently threaten supply chains, categorized by their level of predictability and impact.

A robust supply chain strategy should aim to mitigate disruption in each quadrant. It is the most difficult to anticipate the fallout of events that have low predictability and severe impact.

These disruptions are sometimes referred to as “unknown unknowns” or “Black Swans.”<sup>[07]</sup> They are difficult to foresee and strategize against, and the coronavirus pandemic has shown that these Black Swans demand sufficient attention in order to avoid their devastating aftermath. A resilient supply chain will allow your organization to cope better with a range of different disruptions, both known and unknown.

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



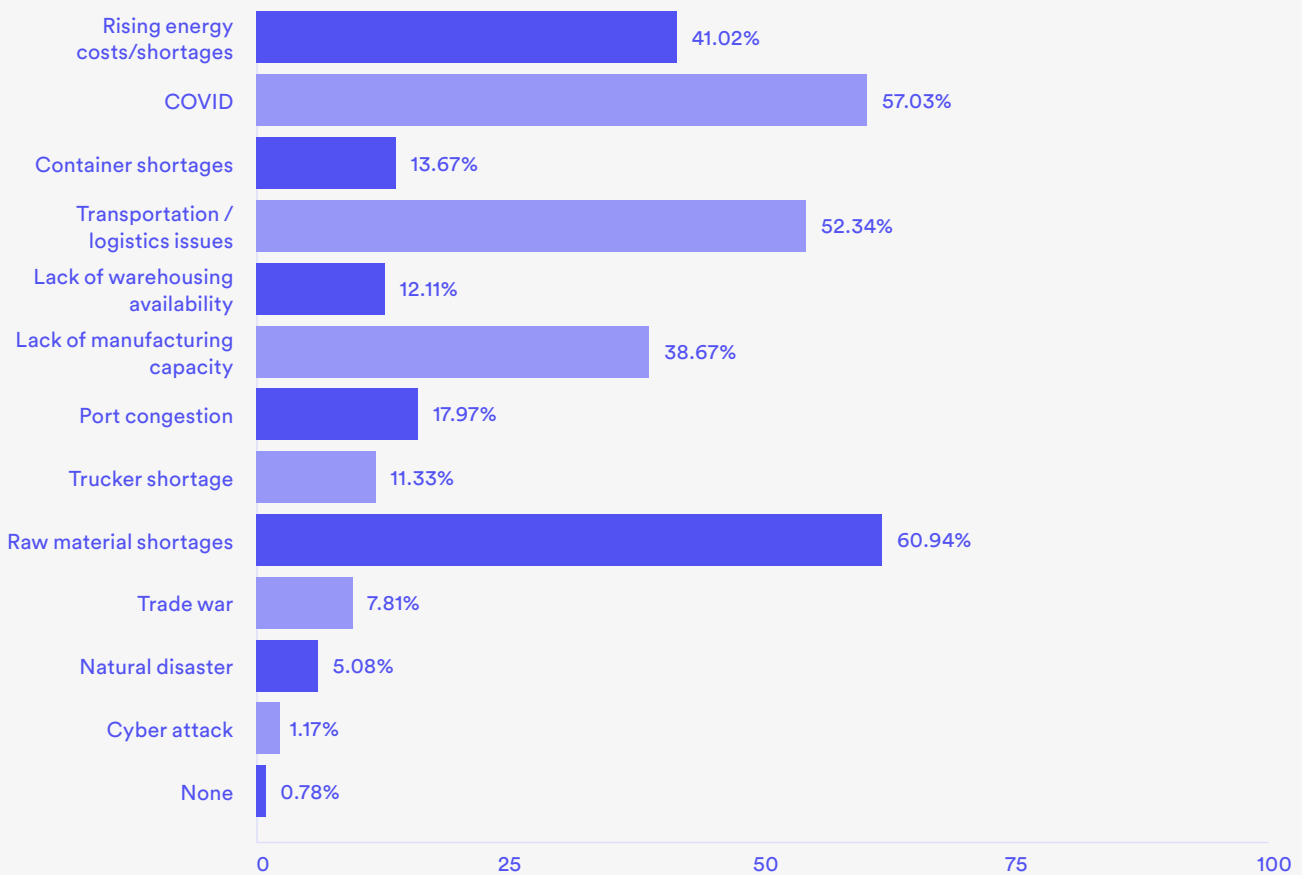
Source: Hubs

# Top supply chain concerns

A survey conducted by Hubs in November 2022 with 334 respondents found that 76.6% of companies experienced some form of external disruption to their supply chain over the past year. This represents a rise in disruptions compared to the results of surveys conducted in 2020 and 2021. In the 2022 survey, material shortages were the top challenge, affecting 60.9% of participants. Likewise, 49.4% of respondents reported facing material shortages more often in 2022 compared to 2021.

COVID-19 was the second biggest cause of disruptions, affecting 57% of companies in 2022. China's strict lockdowns, driven by its zero COVID policy, have severely affected the manufacturing output in the world's manufacturing powerhouse. For example, the output of Apple iPhones is likely to drop by 30% due to COVID-related curbs at Foxconn's factory in Zhengzhou.<sup>[08]</sup> Other significant concerns among survey respondents included rising energy costs, logistics issues, container shortages, port congestion, natural disasters, and trade wars.

**Figure 3: Top supply chain disruptions that have impacted businesses in 2022**

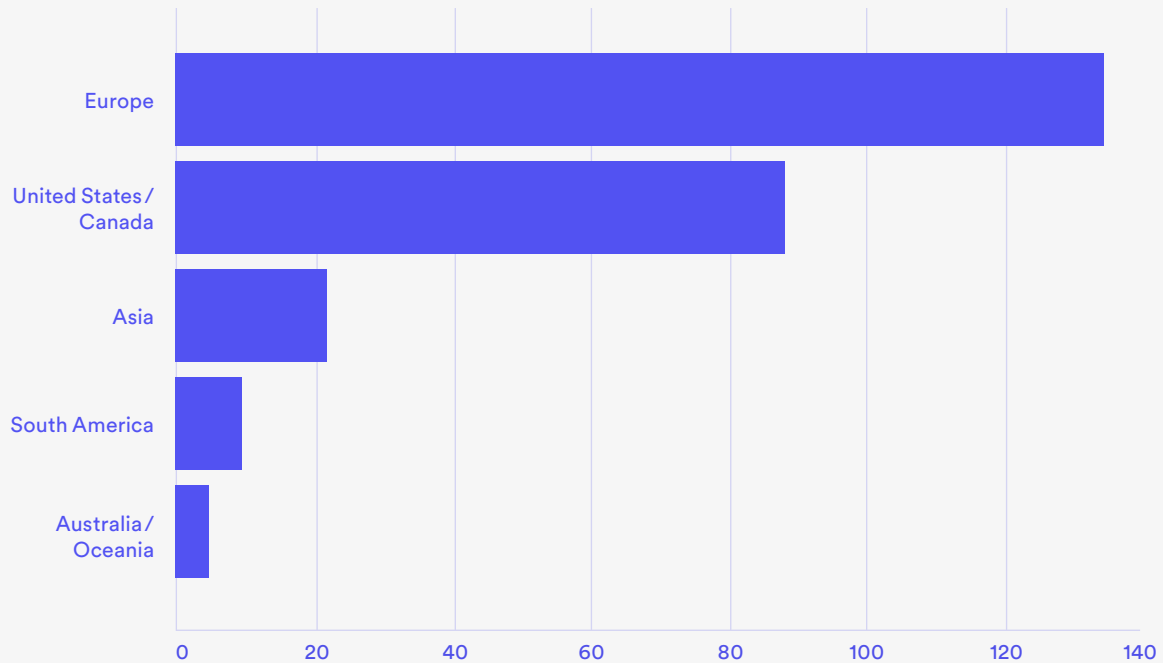


Q: Which supply chain disruptions have impacted your business in the past year?  
Multiple selections allowed, Source: Hubs survey, 334 participants, November 2022

With a military conflict at its door, businesses in Europe experienced widespread supply chain disruptions. In contrast, Asia, home to manufacturing hubs such as China and India, fared better, as shown in Figure 4.

The automation and robotics industry was the most affected by supply chain disruptions, followed by the electronics and medical corporations.

**Figure 4: Regions affected by supply chain disruptions in 2022**



Source: Hubs survey, November 2022

## Key differences between the finding of 2021 & 2022 surveys

1. The results of the 2022 survey show that 70% of participants have implemented measures to improve their supply chain resilience, compared to 63% in 2021. This indicates that companies are increasingly recognizing the importance of preparing for supply chain disruptions.
2. In the 2021 survey, 26.8% of respondents considered the pandemic as a major supply chain concern. This number has increased significantly in the 2022 survey, with 57% of respondents citing it as the second biggest concern.
3. 49.4% of respondents reported experiencing more raw material shortages in 2022 compared to 2021.

The following sections analyze a range of disruptions that were a major concern in 2022.

# Geopolitical issues

## **The Ukraine war brought global supply chain to its knees**

In addition to the tragic loss of lives, the ongoing Russia-Ukraine war has significantly impacted global supply chains. The conflict has disrupted essential air freight and shipping routes, leading to disruptions in the supply of raw materials and finished goods.<sup>[9]</sup> Unsurprisingly, 45.3% of businesses reported being impacted by the war in our 2022 survey.

The war has far-reaching consequences. In 2020, Russia accounted for approximately 29% of crude oil and 43% of natural gas imports into the EU. The fresh round of sanctions against Russia has led to a significant increase in energy costs across Europe.<sup>[10]</sup> As a result, many metal and chemical factories in Europe went dark in 2022.<sup>[11]</sup> This aligns with the findings of our survey, where 55% of respondents expressed concern about the impact of rising energy costs on their businesses, and 55.6% of participants were worried about the impact of these costs on Europe's manufacturing capabilities.

## **The US-China trade war showed no sign of slowing down**

The increased tariffs and trade barriers between the US and China have disrupted the flow of goods and materials between the two countries. This has made it more expensive and difficult for businesses to import and export goods.<sup>[12]</sup> As a result, many businesses have had to find alternative suppliers or production locations, disrupting their supply chains and increasing their costs. The uncertainty and instability caused by the trade war have also made it harder for businesses to effectively plan and manage their supply chains.

In what's now considered a new cold war, the US recently doubled down on its efforts to deprive China of semiconductor technology.<sup>[13]</sup> In addition to the organizations, the US government now bars its citizens from supporting the development or production of advanced chips at Chinese facilities.<sup>[14]</sup>

## **Worker strikes hampered supply chains across the globe**

The US saw more worker strikes in the first half of 2022 than in all of 2021.<sup>[15]</sup> North of the border, Canada was hit by the truckers' protest that impaired the supply chains in the country.<sup>[16]</sup> Across the pond, UK port worker strikes strained the supply chains.<sup>[17]</sup> Spain also faced supply chain issues driven by truck drivers' strikes.<sup>[18]</sup> Meanwhile in South Korea, the truckers' protests disrupted production as well as the supply chain.<sup>[19]</sup>

## **Rising shipping costs hurt the bottom lines of businesses**

The steep rise in shipping costs significantly impacted businesses across the globe. In March 2022, it cost an average of nearly \$10,000 to ship a 40-foot freight container, almost seven times more than in March 2020.<sup>[20]</sup>

The higher freight costs contribute to the overall cost of goods and materials, making it more difficult for businesses to compete in the global marketplace. The increased shipping costs are an obstacle for businesses looking to access new markets and eat into profits for established businesses, making supply chain management more challenging.

# Natural disasters

In recent decades, the world has faced more frequent and increasingly severe natural disasters. Hurricanes, floods, fires, and droughts have devastated communities and entire ecosystems. They also have a major impact on supply chains. They can halt or slow production, reroute resources, damage vital infrastructure, and more. Natural disasters cannot themselves be prevented, but their impacts can be mitigated through strategic investments and reinforcing supply chains.

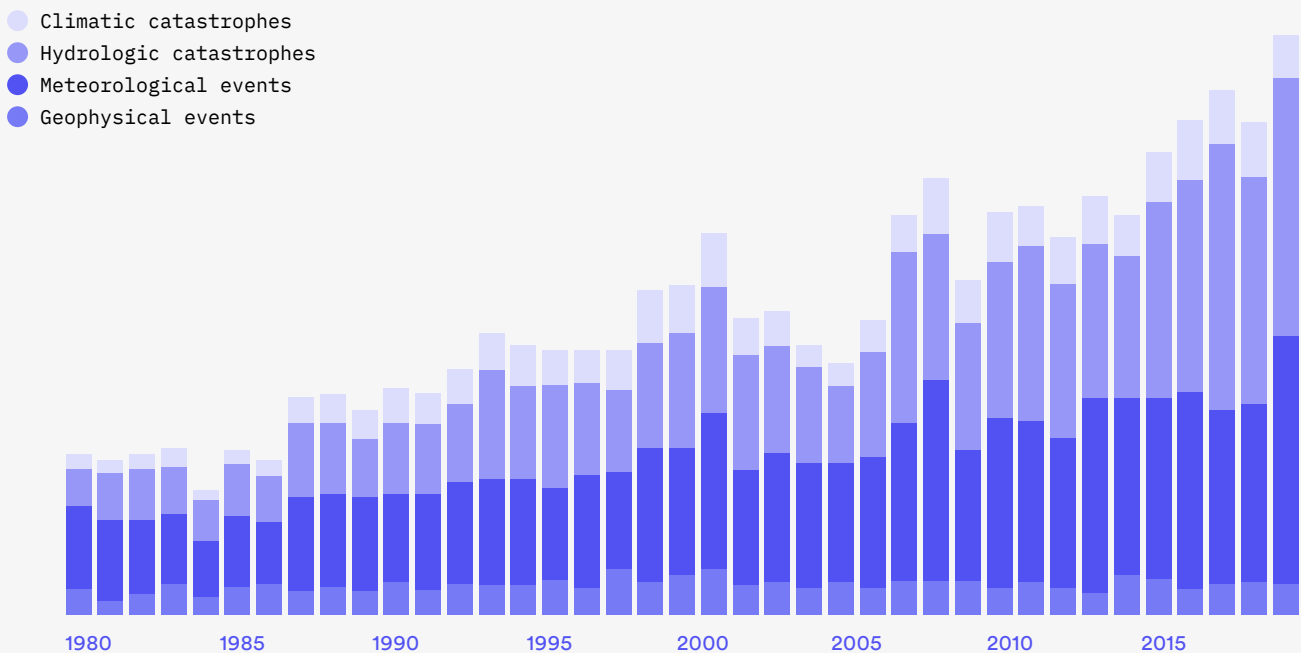
In the year 2021 alone, 401 natural disasters were recorded globally.<sup>[21]</sup> In the United States, natural disasters cost the economy to the tune of \$145 billion in 2021, making it the third costliest year after 2017 and 2005.<sup>[22]</sup>

In summer 2022, a record-breaking heat wave and drought in China caused disruptions and even closures of shipping routes such as the Yangtze.<sup>[23]</sup> As a consequence, China experienced an energy crisis. Automakers with facilities in Sichuan—both Toyota and Tesla have operations there—were forced to halt production due to power cuts, causing knock-on effects for the Chinese economy and global automotive supply chains.<sup>[24]</sup>

Cargo shipments along the Rhine, one of Europe's key trade routes, were also slowed due to a drought in summer. Delays caused by the drought are expected to slow Germany's economic growth in 2022 by as much as half a percentage point.<sup>[25]</sup>

In the US, Hurricane Ian caused over \$60 billion in damages and is expected to cut Florida's economic growth in Q3 by 3 percentage points and 2 percentage points in South Carolina.<sup>[26]</sup> Flooding in Southeast Australia in October 2022 is expected to cost the country \$5 billion in lost economic activity and drive inflation up by 0.1 percentage points.<sup>[27]</sup>

**Figure 5: The rising number of noneconomic disruptions**



Source: McKinsey Agile Operations

# Cyber security

As companies become increasingly reliant on digital solutions to accelerate and streamline operations, it becomes more important to invest in robust cybersecurity measures and technologies. Today, cybersecurity threats, such as data breaches and ransomware, pose a real danger to intellectual property (IP) and supply chains. Weak security systems, software vulnerabilities, supplier fraud, and third-party integrations can lead to financial losses and operational disruptions.

In Japan, manufacturers have been the biggest targets for cyberattacks, with data and entire digital systems held for ransom. Toyota was forced to shut down domestic production in Japan after a cyberattack at a major supplier in Q1 2022.<sup>[28]</sup> The event illustrated how a single supplier undergoing a cyberattack can bring an entire production chain to a standstill.

In 2021, IT solutions company Kesaya was the victim of a supply chain ransomware attack, which in turn compromised as many as 1,500 businesses around the globe. In Sweden, 800 Coop grocery stores were forced to close because the attack had shut down their cash register operating systems.<sup>[29]</sup>

Cybercrime reportedly cost the US businesses over \$6.9 billion in 2021 — an increase of \$2.7 billion from 2020.<sup>[30]</sup> The same year, 62% of large enterprises in IT, security, development, and DevOps, reported experiencing a software supply chain cyberattack — and 31% reported it having a significant or moderate impact.<sup>[31]</sup>

# Five supply chains risks to watch out for in 2023

As we move into 2023, many of the supply chain challenges experienced in 2022 will likely stick around or even escalate. To make matters trickier, there may be other disruptive events on the horizon.

## 1. China-Taiwan crisis could worsen the global semiconductor shortage

Escalating tensions between China and Taiwan have raised concerns about a military conflict in the region. This could destabilize Asia and have serious consequences for global supply chains.<sup>[32]</sup> Taiwan is a leading producer of semiconductor chips and disruptions to its production capability could further exacerbate the global chip shortage and impede the production of smartphones, computers, vehicles, and electronic appliances.<sup>[33]</sup> The involvement of other countries, such as the United States and Japan, could further increase trade tensions with China.

## 2. No swift solution in sight for port congestion

Global shipping delays initially triggered by the COVID-19 pandemic and subsequently aggravated by the Suez Canal blockage and the invasion of Ukraine are expected to continue into 2023. Barring any other unpredictable obstructions or major labor disputes, port congestion and the consequential higher shipping rates are expected to improve gradually as early as Q2 2023.<sup>[34]</sup>

## 3. Inflation can disrupt supply chains by causing uncertainty in demand

With inflation at its highest in three decades and the cost of labor, materials, energy, and transportation rising, supply chain costs are also rising. These higher costs are reflected in commodity prices, and as the cost of living increases the more consumer behaviors and demands change.<sup>[35]</sup> A rigid supply chain can collapse if it can't adapt to uncertainty in demand. Inflation also comes with other risks, such as labor strikes and a greater chance of bankruptcy, which can disrupt trade networks.

## 4. Surge of COVID cases in China may hamper manufacturing capabilities

China's enduring zero-COVID policy and an increase in outbreaks in various cities led to a number of major lockdowns in 2022, which has impacted supply chains. A lockdown in Zhengzhou in November 2022, where Apple operates its biggest iPhone production facility, caused delays for Apple customers around the world. As long as the country's zero Covid policy is in effect, supply chains are susceptible to sudden disruptions due to factory closures or capacity reductions.<sup>[36]</sup>

## 5. New carbon emission regulations may lead to slower movement of goods

New regulations designed to curb carbon emissions may lead to slowdowns in shipping speeds. As instructed by the International Maritime Organization, cargo ship operators must monitor and decrease emissions in 2023. In order to meet their emission targets, older cargo ships will either have to be upgraded or cruise at 10% slower speeds.<sup>[37]</sup> The decrease in transport speeds is expected to create supply chain lags.



# Six industries that will face supply chain disruptions in 2023

## 1. Automobile

The European automobile industry is facing significant challenges due to the energy crisis in the region.<sup>[38]</sup> French and German carmakers, including Mercedes, BMW, and Renault, have been among the hardest hit. This is mirrored in Hubs' survey, which identified rising energy costs as the top concern for the automotive industry.

European automakers are also dealing with the closure of steel and aluminum plants, leading to reduced output predictions by hundreds of thousands of vehicles. According to Europe's metal trade association, 50% of the EU's aluminum production capacity is now offline due to the ongoing power crisis. It is expected that these challenges will continue to impact the automobile industry through 2023.<sup>[39]</sup>

## 2. Aviation and aerospace

Russia's airspace plays a crucial role in global air travel, serving as a link between Europe and Asia. However, Russian airspace restrictions have forced international carriers to take longer, more expensive detours, reducing the profitability of an industry already struggling in the wake of the COVID-19 pandemic.<sup>[40]</sup>

Furthermore, the ongoing Russia-Ukraine war has disrupted the aircraft manufacturing industry by causing a shortage of titanium, which is a key component in the production of modern commercial aircraft.<sup>[41]</sup> These events highlight the need for increased supply chain resilience in the aviation industry.

## 3. Medical

The Ukraine war is leaving a significant impact on the medical industry as well. In its latest survey, Hubs found that raw material shortages were the top concern for the pharmaceutical industry. This is in part due to the rising cost of metals and plastics used in medical devices, which has been exacerbated by the Ukraine war.

Furthermore, the US Food and Drug Administration's clinical trial database indicates that many research sites in Ukraine, which were previously conducting over 250 active trials, are now under threat.<sup>[42]</sup>

## 4. Electronics

The Russia-Ukraine conflict has also disrupted the global supply of semiconductor-grade Neon, a crucial inert gas essential in chip production. As Ukraine supplies about half the world's supply of Neon gas, electronics companies are facing difficulties in obtaining it.<sup>[43]</sup> Additionally, the hostilities between Russia and the international community have disrupted the supply of rare metals, leading to reduced manufacturing output for companies such as Apple.<sup>[44]</sup> The impact of this situation on the electronics industry in 2023 remains uncertain.

## 5. Food and beverage

Ukraine and Russia are the two major players in the global fertilizer market, making them a crucial part of the global food supply chain. The ongoing conflict between the two countries has disrupted the supply of fertilizers, leading to a sharp rise in global food prices.<sup>[45]</sup> With farmers struggling to secure the necessary resources to grow crops. This could lead to further food shortages and price increases in 2023.

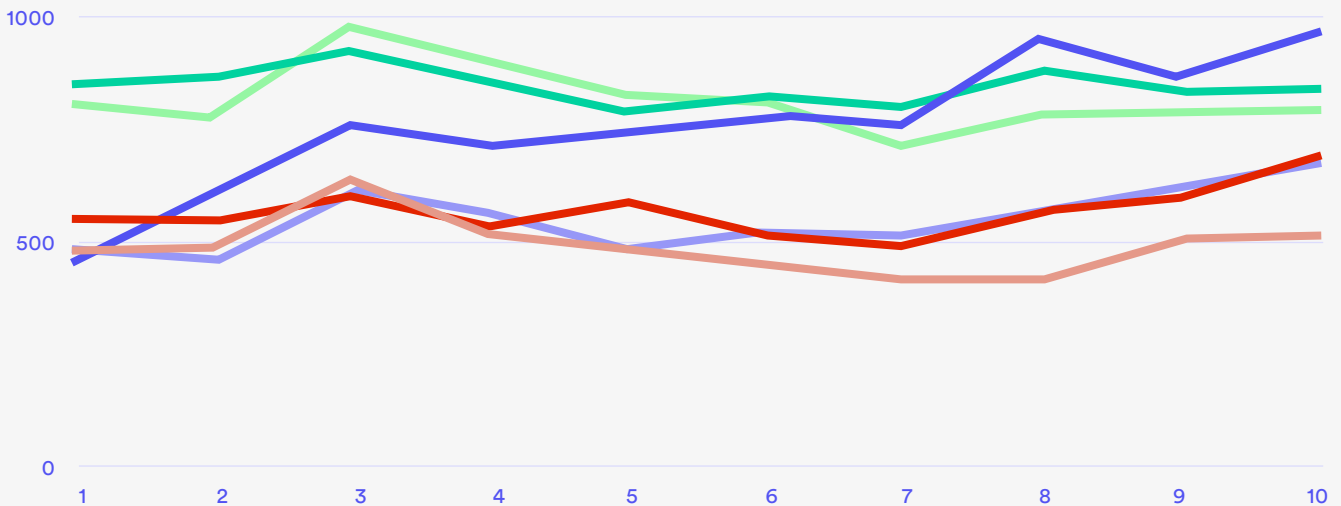
## 6. Consumer goods

The ripple effects of supply chain disruptions are further exacerbating the situation. Many consumer companies are struggling to maintain their operations and are facing financial difficulties. Revlon<sup>[46]</sup> and Hakle<sup>[47]</sup> have already filed for bankruptcy.

# Global online manufacturing supply capacity

Figure 6: Manufacturing orders sourced by continent

- Sourced orders in 2021 (North America)
- Sourced orders in 2022 (North America)
- Sourced orders in 2021 (Asia)
- Sourced orders in 2022 (Asia)
- Sourced orders in 2021 (EU)
- Sourced orders in 2022 (EU)



Source: Transactional data from Hubs online manufacturing platform

China's supply capacity in 2022 underperformed year-on-year, especially for the first half of the year. Meanwhile, North America experienced a significant increase in manufacturing capacity starting in July. Europe saw the most significant growth, surpassing Asia towards the end of the year.

The growth in Europe and North America can likely be attributed to businesses choosing local sourcing and the effects of China's zero-COVID policy, which led to lockdowns in the country.

# Building supply chain resilience

---

Effective measures for mitigating disruption

# Building supply chain resilience

## Five solutions for strengthening supply chains in 2023

As the complexity of supply chains continues to grow and the number of unforeseeable disruptions increases, it is essential for businesses to develop a risk management strategy to address future disruptions. These strategies can help organizations identify potential risks and vulnerabilities in their supply chain and develop plans to mitigate those risks before they become major problems. Unfortunately, despite facing significant supply chain disruptions in recent years, many organizations remain unprepared for future risks.

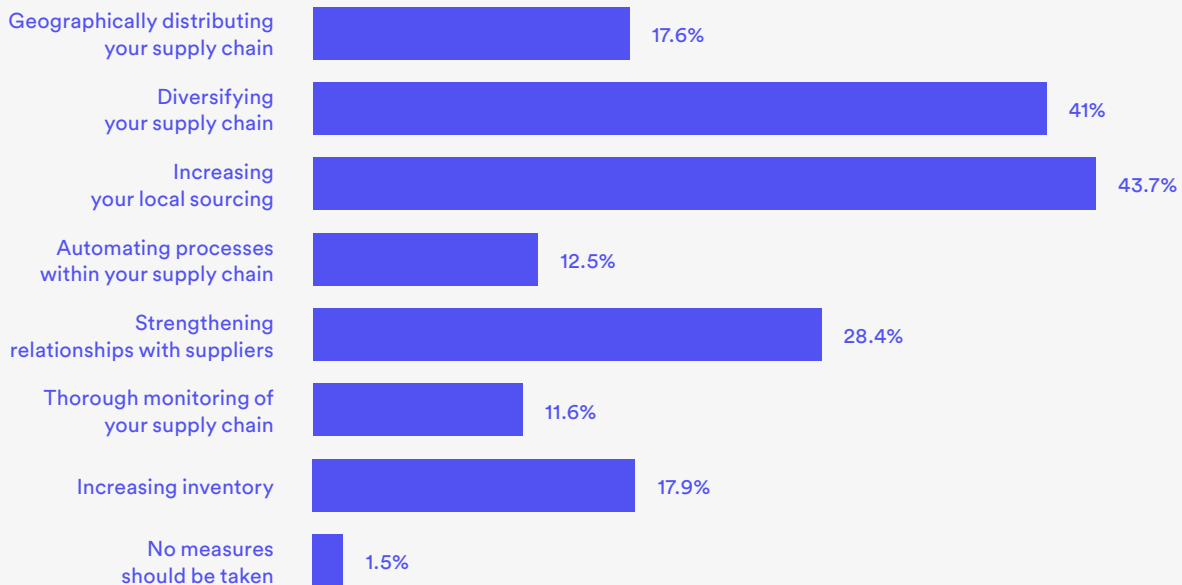
Our survey found that approximately 30% of respondents had not taken any steps to improve the resilience of their supply chain. This is surprising given that 76.6% of surveyed companies experienced disruptions caused by external factors in 2022. It is clear that more needs to be done to ensure that businesses are able to withstand future supply chain disruptions.

For organizations looking to build a resilient supply chain, this chapter focuses on the key elements necessary for preparing for future disruptions, including Black Swan events:

1. Automation
2. Reserve inventory
3. Geographical diversification
4. Agile internal processes
5. Supply chain monitoring

These solutions were echoed by respondents to our recent survey when they listed measures they thought would be the most effective in reducing future disruptions, shown in Figure 7.

**Figure 7: 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?  
Multiple selections allowed, Source: Hubs survey, 334 participants, November 2022

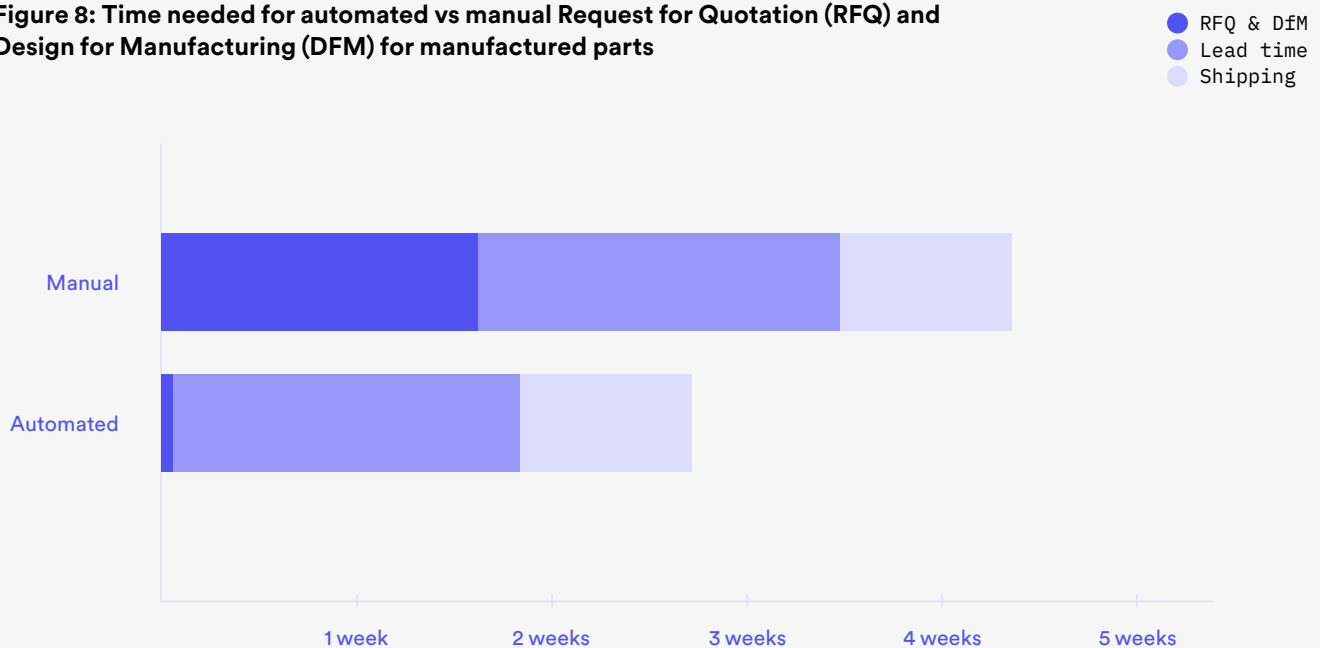
# 1. Automation

Automation can improve supply chains by increasing productivity and efficiency. These processes can mitigate the effects of certain supply chain risks, particularly those related to labor shortages and lockdowns. With Robotic Process Automation, many repetitive manual tasks can be digitized and streamlined, reducing supply chain complexity and reducing reliance on manual labor. In 2021, 78% of organizations were already using RPA technologies, while only 6% had no plans to implement it.<sup>[48]</sup>

Automation is particularly advantageous for its ability to speed up processes that can slow down supply chains if done manually. RFQ and DFM processes can be automated, providing clients with accurate quotes within seconds, rather than days or even weeks. Instead of using traditional, rules-based quoting, [Hubs](#) uses machine learning algorithms to provide instant quotes once a customer uploads a CAD file. The process involves comparing the customer's design to millions of previously manufactured parts. The algorithms use millions of data points collected on part-specific factors such as geometric complexity, volume, material costs, tolerances, secondary processes, and quality control. This is combined with data points on market-specific factors such as global production capacity and the supply and demand of shipping.

Automation across the supply chain also enables businesses to break down silos and streamline the sharing and access of data between supply chain links. Digital Process Automation (DPA) creates greater efficiency by integrating various platforms used in the supply chain, effectively bridging processes and creating greater transparency and visibility. This in turn empowers suppliers to monitor processes and identify inventory needs as well as supply chain bottlenecks and weaknesses.

**Figure 8: Time needed for automated vs manual Request for Quotation (RFQ) and Design for Manufacturing (DFM) for manufactured parts**



Source: Hubs

### **Truck manufacturer automates production line to ease labor shortages**

Based in Illinois, the Knapheide Manufacturing Company has been producing commercial vehicles since 1848, starting with wagons and now specializing in a variety of truck bodies and truck beds. Despite country-wide recruitment efforts, the company has struggled to find a suitable number of skilled workers in recent years, particularly welders, to meet its production demand.

In order to overcome this critical labor shortage, the company has invested in robots to further automate its production lines. In 2022, the truck manufacturer initiated a new production line for flatbed truck bodies using robots to feed steel parts into an automated welding process. The process will enable the company to maintain steady, consistent production rates despite labor shortages.<sup>[49]</sup>

Knapheide has also benefited from the integration of digital processes across its business.

Digital design solutions have enabled it to accelerate product development thanks to an agile approach, scale 3D modeling across its products, and facilitate communication and visibility between shop technicians and engineers.

## 2. Reserve inventory

Though it goes against lean manufacturing strategies, building a reserve inventory can improve supply chain resilience substantially. It effectively creates a buffer so that if or when a link in the supply chain fails, there is enough inventory to keep things up and running while the link is reestablished. It is particularly valuable to have reserve inventory for critical parts and parts that could not easily be sourced from alternative suppliers.

A challenge to the broad adoption of reserve inventory strategies has been cost. However, as AI-driven cost analyses and predictions become more popular, supply chain partners will be able to more accurately predict the probability and cost of supply chain disruptions and weigh those against the costs of reinforcing inventories. In other words, intelligent technologies can make supply chains less reactive and more proactive. Predictive models can also help indicate other changes, such as demand drops or surges, which can help keep production and inventory levels in line with changing consumer trends.

Reserve inventory is an important element in long-term supply chain resilience strategies. Companies that rely on a lean manufacturing approach may benefit from incorporating more risk assessment, predictive models, and inventory buffers into their sourcing strategies.

# 3. Geographical diversification

Diversifying supply chains is essential to building resilience. Many recent events have demonstrated this: pandemic lockdowns in China brought manufacturing to a standstill at various times between 2020 and 2022; while Europe's over-reliance on Russia for gas is leading to significant energy shortages.<sup>[50]</sup> In our latest survey, we found that 41% of companies believe diversifying their supply chain is the best way to avoid disruptions in the future.

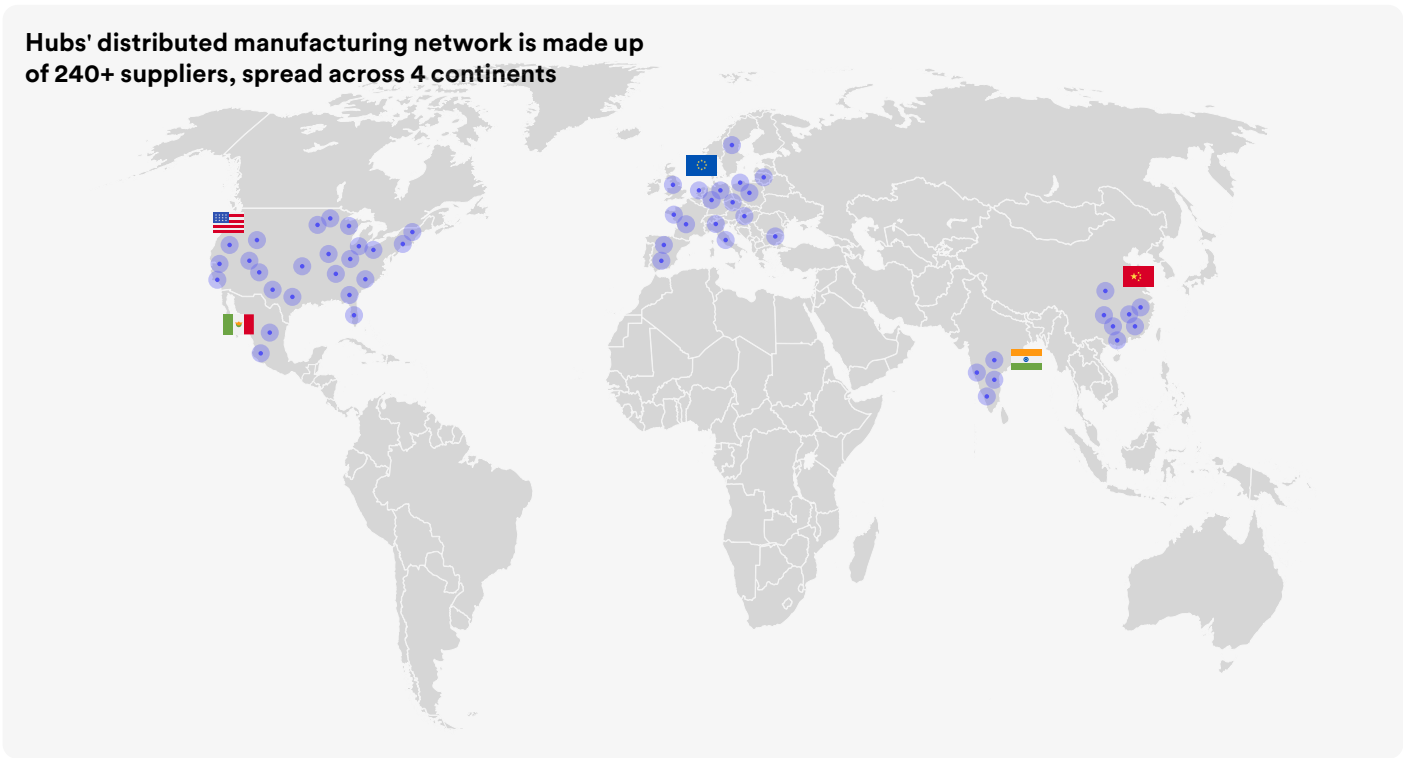
With a strong, distributed network of suppliers or potential suppliers, supply chains can adapt in the face of regional disruptions and changing geopolitics. If one geographic region goes down, suppliers in another can step up and fill the gap.

Enabling the greatest number of qualified manufacturers possible is a critical step to diversifying supply chains. The more complex a product is to make, the more specialized a manufacturer will have to be, which narrows the pool of possible production partners. By simplifying product designs, whether through consolidation or the elimination of complex features, companies will have access to a greater number of potential suppliers.

Building a robust and diverse network of suppliers is a daunting task. However, Hubs' approach to distributed manufacturing simplifies this process by guaranteeing instant access to vetted suppliers.

Hubs expanded its network of local CNC machine shops in the US and Europe, allowing users to choose whether they want to source parts locally or globally. With its [Hubs Local](#) service, customers can order parts from manufacturers within their custom-clearance borders and enjoy lead times as fast as five days.

In a survey conducted by Hubs in 2022, 43.7% of participants cited local sourcing as the most effective way to tackle supply chain disruptions in the future. This highlights the importance of having a diverse network of local suppliers in addition to global ones.





## 4. Agile internal processes

Supply chain resilience is not only about adding flexibility externally – internal processes are also paramount. Startups are typically associated with agile processes, with team members working quickly and dynamically to grow business, but big organizations can also benefit from agility.

By encouraging cross-functionality and greater autonomy across teams, internal processes like product development become faster and more flexible. An agile strategy prioritizes collaboration with clients or stakeholders throughout every stage of development as well as continual improvements based on feedback. This ultimately leads to superior product quality, process transparency, and efficiency, as well as lower risk, since the project is being monitored and evaluated at every step.

With an agile methodology, your internal processes will be more flexible and can seamlessly adapt to market changes. For example, 93% of businesses reported that their agile business units fared better than non-agile business units during the pandemic.<sup>[51]</sup>

Recognizing the importance of collaboration in agile processes, Hubs introduced [Hubs for Teams](#) for its customers. It is a collaborative feature on our [quote builder](#) that allows you to work with colleagues to source custom parts. This feature enables engineers and purchasers to share and review order details in a single place, making it easier and faster to order parts. This can help improve the efficiency of your team's workflow and reduce the time it takes to order parts.

### Tesla mitigates microchip shortages by remaining agile

In the face of a global microchip shortage stemming from increased demand and limited supply, automotive company Tesla has been able to mitigate the challenge by remaining agile. The company, whose vehicles are equipped with microchips for various control systems—including its self-driving software—took a two-pronged approach, switching to the use of microcontrollers in some cases and developing special firmware to accommodate

the use of microchips from a wider range of suppliers. The ability to remain agile in its own processes and retain much of its automotive design and programming in-house, has significantly reduced the impact of the microchip shortage, which is expected to last for years. Whereas other automotive companies have suffered from significant production delays and even stoppages, Tesla has remained largely on track and is better equipped to deal with any microchip shortages down the line.<sup>[52]</sup>

# 5. Supply chain monitoring

In the manufacturing industry, tier-one suppliers are companies that supply parts or materials directly to the original equipment manufacturer (OEM). Tier-two suppliers are vendors that provide parts or materials to tier-one vendors, and tier-three suppliers are companies that provide parts or materials to tier-two. Generally, most businesses only monitor tier one and tier two suppliers as they are considered the most important. However, that's not ideal because even tier-three suppliers can still play a significant role in the overall supply chain. Delays caused by deeper-tier suppliers 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 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 only 11.6% of respondents selecting thorough monitoring of supply chain as an effective measure to reduce the effects of supply disruptions.

Thankfully, specialized software tools have simplified the supply chain monitoring process. Additionally, companies are exploring emerging technologies such as AI and machine learning for supply chain optimization. While only 13.1% of surveyed companies revealed using AI and ML, a resounding 90.9% of the users found it to be useful.

- **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](#) 

# Conclusion

With the ongoing war in Ukraine creating instability in Europe and causing a global energy crisis, as well as an increasing frequency of cyber-attacks and natural disasters, supply chains face a greater degree of risk than ever. It is therefore critical for organizations to transform and upgrade their supply chain processes to minimize vulnerabilities and achieve greater resilience.

Fortunately, there are many tools and strategies for building a resilient supply chain that organizations can use. Automation technologies, diverse supply networks, and moving away from JIT manufacturing models will help establish a robust, future-proof supply chain that can withstand a wide array of disruptions. Resilience is a must for organizations looking to succeed over the long term and adapt to whatever the future brings.

# About this report

**Hubs**  
December 2022

**Editorial:**  
Merritt Gurley & Chandrakant Isi (Hubs)

**Design:**  
Jungeun Lee & Samantha van Roosenbeek (Hubs)

**Contributors:**  
Isaac Simon (Hubs)

## 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 10+ million parts, using various manufacturing technologies, including [CNC machining](#), [3D printing](#), [injection molding](#) and [sheet metal fabrication](#).

## Disclaimer

The information in this report is provided for informational purposes only. This report was based on certain assumptions and information available to Hubs at the date of publication. Hubs does not give an express or implied warranty regarding the correctness or completeness of the information contained in this report. This report may contain forward-looking statements. There is no guarantee that future results, levels of activity, performance or achievements will be realized. You should not place undue reliance on these forward-looking statements. Hubs expressly disclaims any intent or obligation to update any forward-looking statements to reflect subsequent events or circumstances. The information provided by collaborating companies has not been verified by Hubs. The image rights remain with the respective originator at any time. Hubs expresses disclaims any and all liability and will not be liable for any loss or damage arising directly or indirectly (including special, incidental or consequential loss or damage) from your use of this report, howsoever arising, including any loss, damage or expense arising from, but not limited to, any defect, error, imperfection, fault, mistake or inaccuracy in this report, its contents or associated services.

# References

---

- [01] [Building a Resilient Supply Chain, Harvard Business Review](#)
- [02] [Europe's Energy Crunch Will Trigger Years of Shortages and Blackouts.](#) Bloomberg, November 7, 2022.
- [03] [Chemical maker TPC Group files pre-arranged bankruptcy.](#) Reuters, June 2, 2022.
- [04] [Revlon files for bankruptcy in US after supply chain trouble and surging costs.](#) The Guardian, June 16, 2022.
- [05] [European car plants hurt by supply problems linked to war.](#) The New York Times, March 1, 2022.
- [06] [The Evolution of Resilience in Supply Chain Management: A Retrospective on Ensuring Supply Chain Resilience.](#) Journal of Business Logistics, March 2019.
- [07] [What Is a Black Swan Event?](#) Seeking Alpha, May, 05, 2022
- [08] [Output of Apple iPhones at major China plant could fall 30% amid COVID curbs.](#) Reuter, October 31, 2022
- [09] [How the Russia-Ukraine war is worsening shipping snarls.](#) CNBC, March, 11, 2022
- [10] [The impact of the war in Ukraine on energy prices.](#) The Centre for Economic Policy Research (CEPR), October 7, 2022.
- [11] [‘Crippling’ Energy Bills Force Europe's Factories to Go Dark.](#) The New York Times, Sept. 19, 2022
- [12] [Trade war leaves both US and China worse off.](#) United Nations Conference on Trade and Development, 06 November 2019.
- [13] [The U.S.-China Trade War Has Become a Cold War.](#) Carnegie Endowment, September 16, 2021.
- [14] [Biden's chip controls may force Chinese-Americans working in China's semiconductor firms to choose between their citizenship or their job.](#) Yahoo! Finance, October 13, 2022.
- [15] [Workers are getting bolder. The number of strikes tripled from last year as Americans see their wages shrink and bosses profit.](#) Business Insider, September 17, 2022.
- [16] [Supply Chain Issues Could Worsen If Truckers' Protests Continue.](#) Forbes, February 11, 2022.
- [17] [Wave of port strikes put global supply chains under fresh pressure.](#) Politico, August 15, 2022.
- [18] [Spanish truck driver strike triggers supply chain chaos.](#) Anadolu Agency (AA), 22, March, 2022.
- [19] [South Korean production and shipping disrupted as truckers strike for third day.](#) Reuters, June 9, 2022.
- [20] [Sky-high shipping costs could keep prices surging until mid-2023.](#) Business Insider, March 21, 2022.
- [21] [Annual number of natural disaster events globally from 2007 to 2021.](#) Statista, May 13, 2022.
- [22] [2021 U.S. billion-dollar weather and climate disasters in historical context.](#) Climate.gov, January 24, 2022.
- [23] [China drought causes Yangtze to dry up, sparking shortage of hydropower.](#) The Guardian, August 22, 2022.
- [24] [Lights out for Shanghai's Bund as China heatwave sparks power cuts.](#) France24, August 22, 2022.
- [25] [Low Rhine water levels threaten Germany's economic growth.](#) Reuters, August 10, 2022.
- [26] [Hurricane Ian could put a dent in US GDP growth.](#) CNN, October 3, 2022.
- [27] [Australian budget forecasts heavy hit to economy due to floods and disasters.](#) The Guardian, October 25, 2022.
- [28] [Toyota stops production in Japan after a cyberattack at a supplier.](#) The New York Times, February 28, 2022.
- [29] [Up to 1,500 businesses affected by ransomware attack, U.S. firm's CEO says.](#) Reuters, July 6, 2021.
- [30] [Internet Crime Report 2021.](#) Federal Bureau of Investigation, September 2022.
- [31] [2022 Security Trends: Software Supply Chain Survey.](#) Anchore, January 19, 2022.
- [32] [The cost of the Suez Canal blockage.](#) BBC, March 29, 2021.
- [33] [China-Taiwan standoff might increase Global chip shortage.](#) AIM, August 5, 2022.
- [34] [Global port congestion, high shipping rates to last into 2023.](#) Reuters, June 15, 2022.
- [35] [How does inflation impact the Supply Chain?](#) Zurich, September 5, 2022.
- [36] [Apple: iPhone shipments delayed over China Covid lockdown.](#) BBC News, November 7, 2022.
- [37] [Why shipping might be about to get a little bit slower.](#) World Economic Forum, July 13, 2022.
- [38] [How Russia's war is cutting global auto production.](#) CNBC, April 16, 2022.
- [39] [Europe's Carmakers Brace For 2023, While VW Volume Brands Could Lose Money.](#) Forbes, November 8, 2022.
- [40] [Flights are taking huge 'detours' around Russian air space.](#) CNN, March 24, 2022.
- [41] [The Titanium Supply Chain For The Aerospace Industry Goes Through Russia.](#) Forbes, March 6, 2022.
- [42] [Clinical studies in Ukraine.](#) U.S. National Library of Medicine.
- [43] [Russia's attack on Ukraine halts half of world's neon output for chips.](#) Reuters, March 11, 2022.
- [44] [Battery makers seek price hikes on lack of Russia rare metals.](#) Nikkei Asia, July 18, 2022.
- [45] [Ukraine war 'catastrophic for global food'.](#) BBC, March 7, 2022.
- [46] [Revlon files for bankruptcy, blames supply chain snags.](#) Reuters, June 17, 2022.
- [47] [Toilet paper manufacturer Hakle is insolvent – prices are rising.](#) Switzerland Times, September 6, 2022.
- [48] [Automation with intelligence: Pursuing organisation-wide reimagination.](#) Deloitte, 2021.

[49] [North American companies send in the robots, even as productivity slumps.](#)  
Reuters, August 29, 2022.

[50] [Share of gas supply from Russia in Europe in 2021.](#) Statista, October 7, 2022.

[51] [Agile resilience in the UK: Lessons from COVID-19 for the 'next normal'.](#)  
McKinsey, October 13, 2020.

[52] [How Tesla pivoted to avoid the global chip shortage that could last years.](#)  
Electrek, May 3, 2021



Supply chain resilience report 2023  
Copyright © 2023 3D Hubs B.V.  
All rights reserved.