



EDCC'S DRIVE | LEAD | SUCCEED
Thought Leadership Series
Mapping the Supply Chain



Thought Leadership Series

OUR HISTORY

Established in 1976, the Economic Development Council of Colorado (EDCC) promotes effective, responsible economic development practices across Colorado. Today we are the state's premier economic development resource, representing the economic development interests of both the private and public sectors throughout the state. We connect our communities, our members and our partners to high-quality educational opportunities and trusted resources, and advocate for sound policies and programs that support a vibrant economy and enhance quality of life for all Coloradans.

EDCC members come from a variety of settings. We are rural and urban, public and private-sector, for profit and not-for-profit, and include individual communities, counties and regional organizations, local and state government, chambers of commerce, universities, and private industry. We are economic development professionals, community volunteers, and business and political leaders.

OUR VISION

To be recognized as Colorado's most trusted resource for economic development stakeholders committed to promoting a vibrant Colorado economy.

OUR MISSION

To promote effective, responsible economic development by connecting Colorado's economic development stakeholders to high-quality educational opportunities and trusted resources and advocating for sound policies and programs that support a vibrant economy and enhance quality of life for all Coloradans.

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Economic Development Council of Colorado

Executive Summary

SUPPLY CHAIN OVERVIEW

– Rob Newbold, Director of Client Services, Manufacturer's Edge

Supply chain disruptions have been a key headline for more than two years. From electronics, to automobiles, baby formula, steel and toilet paper, we've experienced global shortages of the things that we use and expect everyday. At a broad level, we understand there are many factors that have influenced this breakdown of a system that we assumed to be stable and precise. However, the warning signs of breakdown have been building for years. COVID's impact has been multi-faceted in further upending a tenuous link of chains that ensure we get what we want.

These six trends have many connections to the conversations that you'll be hearing today. We tend to look at a list like this and say, "These are issues outside of my purview and control. What can I do?" What we fail to consider is that at the starting point, every supply chain breaks down to a simple system that manufacturers and you can influence – that is the proactive and effective management of risks and relationships.

Six key trends impacting global supply chains in 2022
From logistics disruption, to workforce and labour

1. Logistics Disruptions
2. Production Delays
3. Over-reliance on a limited number of third-parties
4. Doubling down on technology investments
5. Commodity pricing
6. Workforce and Labor

KPMG

<https://home.kpmg/au/en/home/insights/2022/03/six-key-trends-impacting-global-supply-chains-in-2022.html>

Our goal is to provide you with trends, tools, and activities that you can use with your local manufacturers to help shrink the complexity and concerns around supply chain disruptions in your community. Supply chains will remain fluid for some time as political landscapes shift, labor shortages grow, climate change drives population upheaval and consumer preferences change. Manufacturers, distributors, and customers want more visibility and immediacy in sourcing; however, the true test of our future supply chain is in its resiliency to changing conditions. A better understanding of the resources available to support manufacturers will give us more leverage to influence those changing conditions.

DEFINITIONS & DESCRIPTIONS

Let's start with a definition of supply chain. A supply chain is defined as the sequence of processes involved in the production and distribution of a commodity. While true, this definition comes across as one step leads to the next. In today's world, we know that multiple factors come together to make, distribute, and sell products, so a more complete definition would be of a supply chain network that describes the movement of both materials & information, assessing the programs and policies that impact the supply chain. Most business units in an organization have an interest in efficient supply chain operations. In a highly networked world, the concept of both goods and materials flowing through processes along with information is critical to ensuring that consumers receive their goods when they want them.

In a supply chain network, the flow of raw materials from second or third tier material suppliers up to first or second tier manufacturers who refine the materials into parts that are shipped to the final assembly manufacturers. Larger manufacturers may know who their first or second tier suppliers are, yet rarely know who supplies these suppliers with raw materials, leaving visibility gaps in the flow of materials and information to the right sources along the network. From the manufacturers, the flow of finished goods goes through distributors which may also be one to three layers deep before being delivered to the customers. In the opposite direction of materials and goods, information regarding the pace of ordering, demand for products, and status of products on the shelves must flow down to the distributors, then to manufacturers and finally to the network of small material suppliers. At each level, information becomes more disjointed and less accurate affecting forecasting, ordering, scheduling of production and staffing levels needed to meet demands. Good information systems, stable ordering, consistent staffing, and solid distribution suppliers are all necessary to make a supply chain network operate effectively. What has happened over the last two plus years is a disruption to each of these that has compounded the risks and resulted in major shortages on our shelves.

Goals of a stable supply chain network and the participants in the network are simple:

- Cost effectiveness – Getting materials and products at the lowest price per unit or the lowest total cost of ownership are two very different strategies on which to secure products but have a direct relationship to reshoring initiatives.
- Efficiency & Productivity – Receiving accurate forecasts, timely delivery of materials to manufacture products, and efficient, reliable methods to find, qualify and onboard new vendors are all elements that support a stable supply chain network.
- Quality – Materials and products made to exact specifications that meet the delivery timeframes at the costs agreed to is the holy grail of supply chains. Often poor quality parts cause ripple effects of cost increases, missed deadlines, and lost productivity which add to the unreliability of the supply chain.
- Resilience & Risk Reduction – Evaluating geopolitical, transportation and other risks while elevating resiliency through multiple supplier sources, forecasting accurately, and moving suppliers as close to your operations as possible (reshoring, clustering, etc.) can have huge impacts on costs and operational efficiency.

In macro-terms, being successful in all four of these goals in large manufacturing companies has been a major challenge before and following the pandemic; for smaller manufacturers, the challenges have literally created a survive at all costs approach.

Since 2020, stories abound like the small manufacturer who produces equipment for the Department of Defense. DOD requires full US-made parts in their contracts, so the manufacturer asks to buy printed circuit board from their standard suppliers and can't, because all stock production has been dedicated to large Original Equipment Manufacturers (OEMs) up to 18 months out – meaning earliest delivery is Q2 of 2024 – at 3 to 10 times the normal prices.

SUPPLY NETWORK DISTINCTIONS IN LARGE MANUFACTURERS AND SMALL, MID-SIZED ENTERPRISES (SME'S)

Growing examples of shortages, price increases, lack of production capacity due to low staffing, and higher transportation costs are common across the manufacturing industry, but the effects on the manufacturers in our communities may be very different. Economic developers can use an understanding of the distinctions that small vs. large manufacturers face in supply chains to help achieve their goals of retention, expansion, and attraction solutions. In addition, tools and concepts that small manufacturers can take advantage of are operational continuous improvement or quality management systems to help stabilize production within their own walls; developing a supplier quality program; setting up min / max limits on materials to limit unnecessary material purchasing; and creating strong culture of communication and awareness among various business units of the high cost, low availability materials in their process to help identify engineering changes that can reduce uncertainty.

The following chart indicates a few of the differences that manufacturers of different sizes face. Smaller companies typically cannot dedicate a single person or team to supply chain procurement or management, leaving them at a disadvantage in pricing, policy development, quality, and sourcing options.

Supply Network Differences	
Large and Small, Mid-size Manufacturers situations are dramatically different	
Large Manufacturers <ul style="list-style-type: none">• Buying Power influences pricing, availability• Dedicated supply chain staff manage long-term contracts• Capital, cash flow is distributed• Expansive product lines reduces risk of loss• Able to have multiple vendors for materials	Small, Mid-Size Manufacturers <ul style="list-style-type: none">• Big buys to avoid price fluctuations• Capital is tied up in materials, not products• Owner, purchasing person – multiple roles• Ineffective at policies, contractual negotiations• Limited product lines & vendors raises potential of significant loss

To overcome this, they must tie up capital in materials that they must hold until scheduling production to turn into products which can become cash. With fewer product lines, a single part or material that isn't available can have serious detrimental effects on their ability to deliver to their customers, meet payroll or adapt their designs to work around this supply chain deficit.

For economic developers looking to support small manufacturers, understanding their manufacturers' top suppliers, what they buy, how often, and alternatives that are acceptable can be a tremendous advantage in ensuring retention and helping assess expansion options and capacity. In terms of recruitment, knowing these supply chain needs in their communities can also influence the type of future manufacturing companies they recruit to support the existing community as suppliers.

TRENDS AND IMPACTS IN THE MANUFACTURING ECOSYSTEM

- Nico Thomas, Performance Analyst, National Institute of Standards and Technology
- Mark Schmit, Manager of National Accounts, Manufacturing Extension Partnership

The pandemic has proven that supply chain disruptions are issues that not only affect businesses, but also the nation and its' local communities. Nationally, the industrial base had difficulty keeping up with the swift and significant increase in demand for medical supplies and personal protective equipment. National defense was at risk with the shortage of semiconductor chips, advanced batteries, and other **key products and critical technologies**. Locally, communities faced shortages in food, water, and other everyday items such as toilet paper and cleaning solution. Supply chain disruptions and resulting product shortages have also led to ripple effects in the economy, including significant price increases for both consumers and producers.

Supply chain disruptions have significantly impacted the U.S. manufacturing sector, particularly small- to mid-sized manufacturers (SMMs). The disruptions go back to the beginning stages of the pandemic. Factories were hit hard by the spread of coronavirus cases. Many factories shut down or were forced to reduce production because workers were sick or in lockdown. In response, shipping companies cut their schedules in anticipation of a drop in demand for moving goods around the world.

Demand for some goods sky-rocketed while demand for other products disappeared virtually overnight. The surge in demand clogged the system for transporting goods to the factories that needed them. At the same time, finished products piled up in warehouses and at ports throughout the world because of a profound shortage of shipping containers.

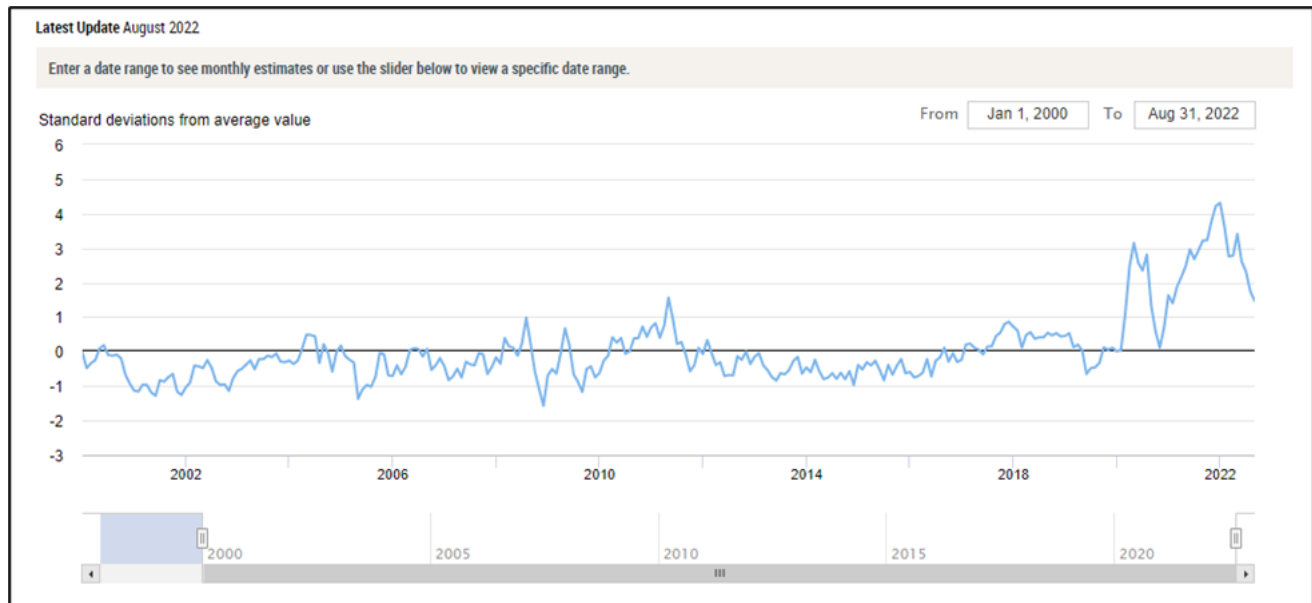
Because containers were scarce and demand for shipping intense, the cost of moving cargo sky-rocketed. Ports in the U.S. were overwhelmed by the high number of ships and no availability of docks. At ports like Los Angeles, ships were forced to anchor out in the ocean for days before they could load and unload. At the same time, truck drivers and dockworkers were stuck in quarantine, reducing the availability of people to unload goods and further slowing the process.

CURRENT SITUATION

These disruptions have placed significant pressure on the global supply chain. The **Federal Reserve Bank of New York** tracks the state of the global supply chain through an index that uses data from the transportation and manufacturing sectors^[1].

¹ <https://www.newyorkfed.org/research/policy/gscpi#/interactive>

For much of the pandemic, supply chains have faced significantly higher pressures than seen in recent decades[2]. Pressure levels have been slowly easing over the past four months but are still significantly higher level compared to recent decades.



Sudden increases in the pressure on the global supply chain are tied to the disruptions we are facing domestically. Shortly after the start of the pandemic the U.S Census Bureau created a **Small Business Pulse Survey (SBPS)** to measure the effect of changing business conditions during the pandemic on the nation’s small businesses[3]. The SBPS provides a near real-time look at the situation businesses face as data is collected from small businesses on operational challenges, vaccine requirements, supply chain impact, outlook and expectations, and much more.

The Census SBPS is conducted weekly and includes a question on whether companies have experienced delays with domestic suppliers. In the latest Census SBPS, collected between April 11th and April 17th, 2022, nearly 45% of U.S. small businesses reported delays with domestic suppliers. The small businesses reporting domestic delays were highly concentrated in the manufacturing (70%), retail trade (67%), and construction industries (63%). While no comparable data set exists prior to the pandemic, the data does suggest that these numbers are significantly higher than usual[4].

2 <https://crsreports.congress.gov/product/pdf/IN/IN11926>

[3] <https://www.census.gov/data/experimental-data-products/small-business-pulse-survey.html>

[4] <https://www.whitehouse.gov/cea/written-materials/2021/06/17/why-the-pandemic-has-disrupted-supply-chains/>

Domestic Supply Chain Disruptions by Sector

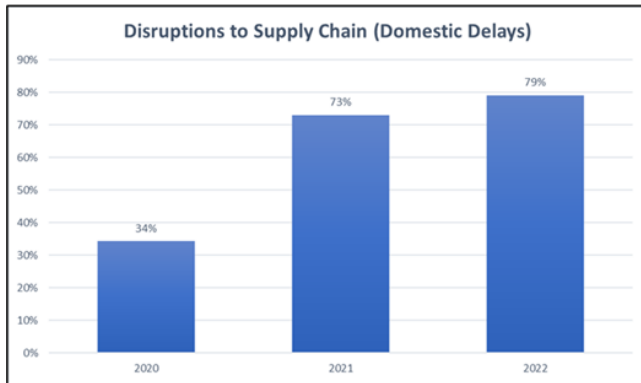
In the last week, did this business have domestic supplier delays? (Percent saying yes)



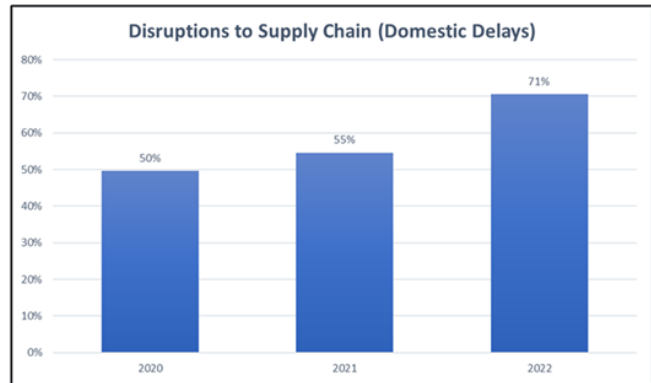
The disruptions to U.S. SMMs have grown rapidly since the beginning of the pandemic, with the disruptions differing in significance from region to region. Leveraging the Census SBPS, data shows that disruptions nationally to the domestic manufacturing supply chain grew significantly from year to year starting in 2020 and reaching a high in 2022. However, there are certain regions where the growth from year to year was even more significant. Colorado is one of those regions, with 34% of SMMs reporting delays with domestic suppliers in 2020 growing to nearly 80% of SMMs reporting delays with domestic suppliers in 2022[5]. Manufacturers in Colorado have been hit harder by domestic supplier disruptions than what we are seeing at the national level.

[5] <https://portal.census.gov/pulse/data/#downloads>

Colorado



United States



SMMs are critical to the U.S. manufacturing base and economy. The pains these companies are feeling echo throughout the nation. According to the [U.S. Census Bureau County Business Patterns](#) dataset, just under 99% of U.S. manufacturing establishments have less than 500 employees. To shed light on just how small U.S. manufacturers are, 91% of manufacturers have less than 100 employees and 69% of manufacturers have less than 20 employees. These companies support a significant chunk of the U.S. manufacturing workforce as well, with manufacturing establishments that have less than 500 employees employing 70% of all U.S. manufacturing employees[6].

Most manufacturers in the U.S. being small is pervasive from state to state. In Colorado, for example, SMMs comprise an even greater share of the industry than nationally. Just over 99% of all Colorado manufacturing establishments have less than 500 employees. Of the total manufacturers, 96% of manufacturers have less than 100 employees and 78% of manufacturers have less than 20 employees. SMMs employ nearly 75% of all Colorado manufacturing employees[7]. Understanding what contributes to the disruptions these SMMS are facing will be critical in mitigating supply chain disruptions. And SMMs inability to find and cultivate a resilient workforce is one such challenge.

Workforce shortages are a contributing factor to the growing supply chain pressures and delays. Although a quick pivot to growth is generally good for businesses and their workers, it can also create challenges. Industries that shrank significantly during the pandemic are now open again and trying to ramp up services. With this quick pivot, many businesses report that they have been unable to hire quickly enough to keep pace with their rising need for workers which has led to all-time highs in job openings[8]. The [U.S. Bureau of Labor and Statistics \(BLS\) Job Openings and Labor Turnover Survey \(JOLTS\)](#) finds that job openings are at levels unseen in the past 20 years. This is true at both the national and state level, as seen in Colorado. Companies want to ramp up capacity and production, but just do not have the staff to do so.

[6] <https://www.census.gov/programs-surveys/cbp.html>

[7] <https://www.census.gov/programs-surveys/cbp.html>

[8] <https://www.whitehouse.gov/cea/written-materials/2021/06/17/why-the-pandemic-has-disrupted-supply-chains/>

Colorado



United States



U.S. business reliance on foreign sourcing has also factored into the supply chain pressures and disruptions. Global supply chains often require a product to pass through several countries before reaching the United States. A delay or disruption in any one of those countries can therefore cause supply problems for companies in the U.S.[9] And the pandemic was found to have affected 98% of global supply chains[10]. Relying on foreign sourcing can be risky, especially for key products and critical technologies.

The pandemic has shown that the U.S. supply chain is vulnerable in some key areas. The U.S. Department of Health and Human Services figures show that 95% of surgical masks and 70% of tighter-fitting respirators, such as N95 masks, are made overseas. And according to the Federal Drug Administration (FDA), nearly 75% of active ingredient manufacturing facilities for medicines sold in the U.S. are located in other countries[11].

The positive news is that U.S. manufacturers and businesses understand the need to reshore. A recent Thomas Industrial study found that 70% of firms surveyed were likely to reshore in coming years. And according to Bloomberg, discussions on supply chain shifts are getting more attention than ever before during corporate presentations – discussing onshoring, reshoring, and nearshoring[12].

U.S. businesses are acting to follow-through on their reshoring discussions. A **recent report** by the Reshoring Initiative found that in 2021 the private and federal push for domestic supply of essential products and technologies drove reshoring and foreign direct investment (FDI) job announcements to a high of 261,000, which is significantly higher than at any point over the past decade[13]. The data shows a widening gap between reshoring and FDI in 2020 and 2021, which indicates that U.S. headquartered companies may be starting to understand the benefits to localized production that many foreign

[9] <https://crsreports.congress.gov/product/pdf/IN/IN11926>

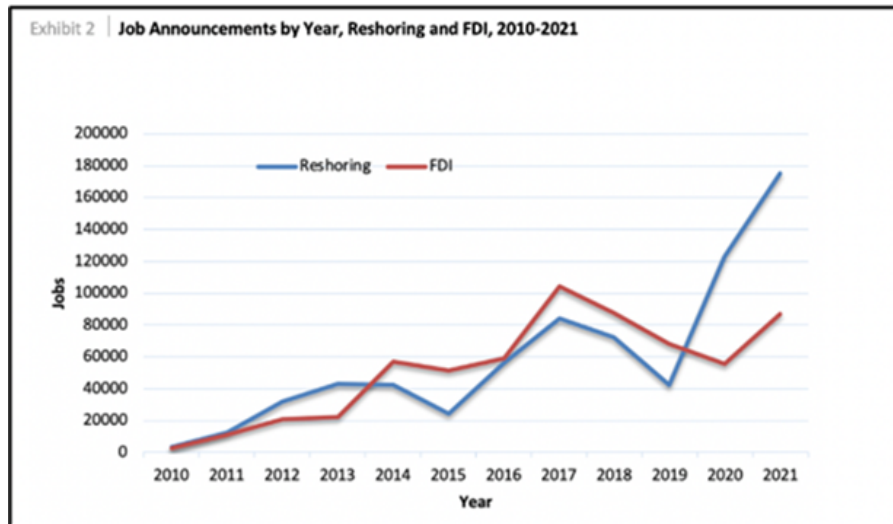
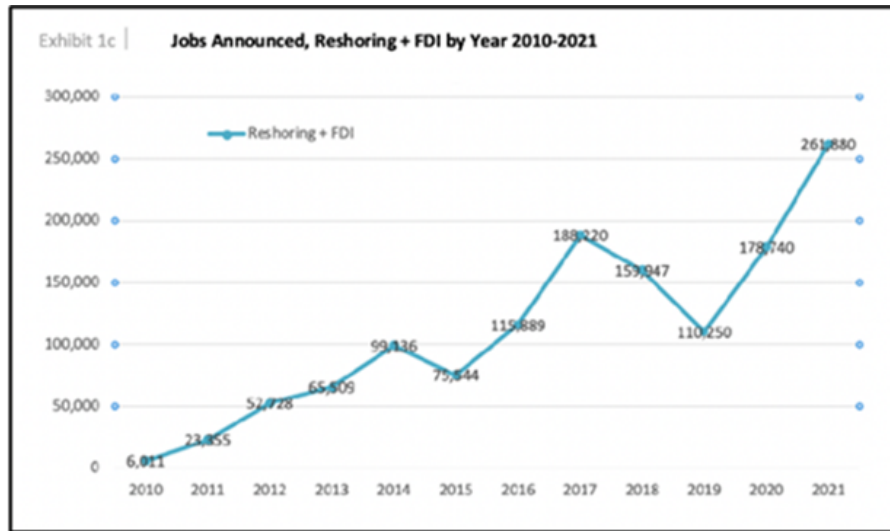
[10] https://www.nist.gov/system/files/documents/2022/03/31/NIST_MEP_ReshoringInfographic-Digital-FINAL-508.pdf

[11] https://www.nist.gov/system/files/documents/2022/03/31/NIST_MEP_ReshoringInfographic-Digital-FINAL-508.pdf

[12] <https://www.bloomberg.com/news/articles/2022-07-05/us-factory-boom-heats-up-as-ceos-yank-production-out-of-china?leadSource=uverify%20wall>

[13] https://reshorenw.org/content/pdf/2021_RI_data_report.pdf

companies have understood over the last decade. The report also includes some data by state, showing that Colorado ranks as the 28th state when it comes to attracting reshoring companies, bringing back nearly 10,000 jobs to the state since 2010[14].



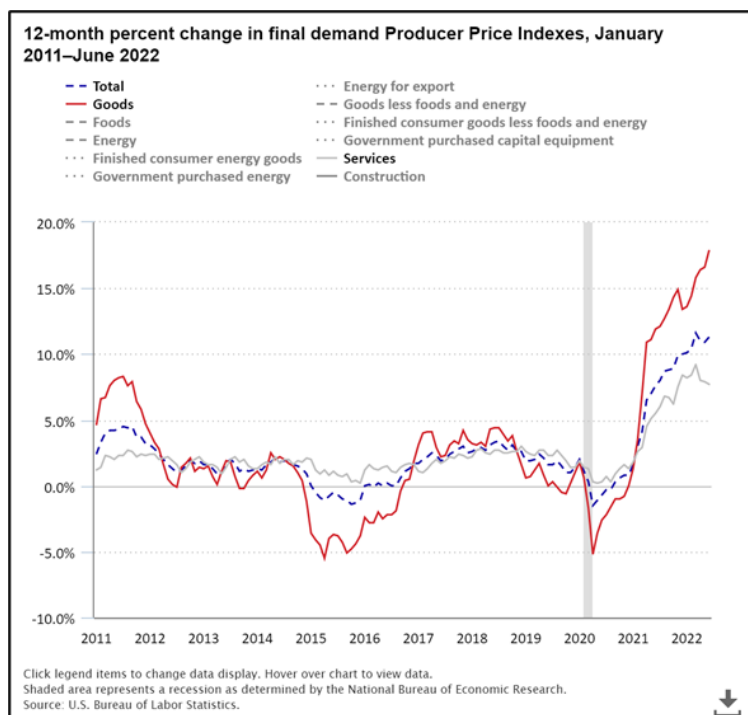
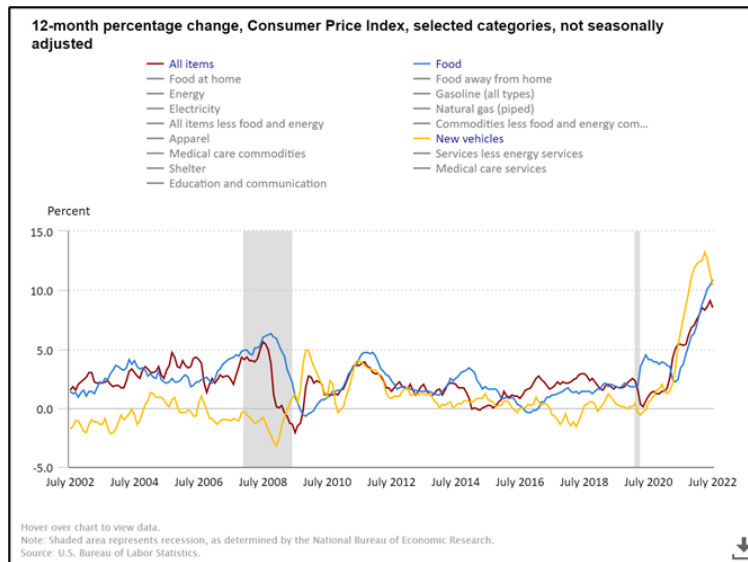
The will to reshore takes time, and reshoring efforts won't relieve the immediate challenges caused by the ripple effects of supply chain pressures and delays. One such ripple effect is the rapidly increasing prices that both domestic producers and consumers are facing. The U.S. Bureau of Labor Statistics (BLS) tracks both the Consumer Price Index (CPI) and the Producer Price Index (PPI). The CPI is a measure of the average change overtime in the prices paid by urban consumers for a market basket of consumer goods and services[15]. The PPI measures the average change over time in the selling prices received by domestic producers of goods and services. PPIs measure price change from the perspective of the seller[16].

[14] https://reshorenw.org/content/pdf/2021_RI_data_report.pdf

[15] <https://www.bls.gov/cpi/questions-and-answers.htm>

[16] <https://www.bls.gov/ppi/faqs/questions-and-answers.htm#1>

Over the last 12 months, CPI for all items increased 9.1 percent for the year ending in June 2022[17]. And the PPI has fared even worse, with the Producer Price Index for final demand increasing by 11.3 percent for the year ending in June 2022. Specifically, the Producer prices for goods rose 17.9 percent, the largest advance since 12-month data were first calculated in November 2010[18]. As depicted by the graphics below, these fast price increases are unlike any we have seen in recent times.



[17] <https://www.bls.gov/opub/ted/2022/producer-prices-for-goods-up-17-9-percent-from-june-2021-to-june-2022.htm>

[18] <https://www.bls.gov/opub/ted/2022/consumer-prices-up-9-1-percent-over-the-year-ended-june-2022-largest-increase-in-40-years.htm>

LOOKING FORWARD

The MEP National Network comprises the National Institute of Standards and Technology's Manufacturing Extension Partnership (NIST MEP), the 51 MEP Centers (such as Manufacturer's Edge in CO) located in all 50 states and Puerto Rico, the MEP Advisory Board, MEP Center boards, and the Foundation for Manufacturing Excellence, as well as over 1,400 trusted advisors and experts at approximately 450 MEP service locations. Each MEP Center is a partnership between the federal government and a variety of public or private entities, including state, university and nonprofit organizations.

The MEP National Network's strength is in its partnerships. Through its collaborations at the federal, state and local level, MEP Centers work with manufacturers to develop new products and customers, expand and diversify markets, adopt new technology, and enhance value within supply chains.

One of the key learnings from the pandemic is that manufacturing customers of all types have a dramatically heightened level of concern over where products and their entire supply chains come from. This presents a significant opportunity for American manufacturers to diversify what they make and who they make it for, and in the process, manufacturers will diversify their customer base and make their relationship to the competitive market more resilient to future disruptions.

MEP sees supply chain resilience and security as integral to U.S. manufacturers' competitive advantage. The global competitiveness of U.S. manufacturing depends on the performance of all companies, at all levels and tiers of the supply chains in which they operate. By working among all levels of supply chains, as well as with individual manufacturers within them, MEP efforts result in high-performing supply chains that collaborate through multiple tiers, creating the capability to develop, manufacture and distribute new or improved products more rapidly.

Three examples of how MEP engages with manufacturing supply chains include:

- The MEP Supplier Scouting program identifies and connects suppliers with purchasers, responding to specific needs by individual companies.
- MEP Centers are working with manufacturers to map their supply chains and populate supplier databases, which will enable MEP to identify required capabilities and potential vulnerabilities.
- MEP Centers provide cybersecurity (DFARS/CMMC) training for manufacturers in the defense industrial base.

Achieving greater resiliency in the domestic supply chain cannot be achieved by businesses or MEP alone, it requires partnership across the entire manufacturing ecosystem. A more dynamic supply chain requires more dynamic supply chain management, planning, and support.

There are several key drivers that have provided an opportunity for stronger coordination between federal governments, state governments, economic developers, and other manufacturing community stakeholders. The global pandemic has put a spotlight on global supply chains, the current Administration has identified national priorities through Executive Orders and Made in America Proclamations[19], and there has been an influx of bills introduced to Congress to address supply chain issues.

With opportunities available, the most important step forward remains working directly with companies. Connecting with companies directly and connecting companies with each other allows for growth and diversification while also strengthening domestic supply chains. More connections uncover more capabilities which can lead to greater capacity.

SOLUTIONS AND PATHWAYS

– Bret Boyd, Cofounder and CEO, Sustainment

Sustainment is a digital manufacturing community of over 50,000 manufacturing executives and technology users across 20,000 companies and growing. Our vision is to reimagine the American manufacturing base as a hyperconnected, secure, and resilient ecosystem of local and regional suppliers, enabling manufacturers to more easily connect and interact with the industry and government organizations that support or rely on them. Our mission, put simply, is to apply technology to help manufacturers find, evaluate, and engage with qualified U.S.-based suppliers and help suppliers showcase their expertise and capabilities to new customers and partners.

Manufacturing is an incredibly large and important industry for the United States, representing 11% of GDP and 12% of employment. Unfortunately, this essential American industry is extremely fragmented and underutilized as a result of decades of offshoring. There are approximately 25% fewer U.S. manufacturing firms and plants now than there were in 1997. Much of the innovation in this space over the past 30 years has been oriented towards helping companies outsource production internationally, and while powerful companies such

[\[\[19\] Administration priorities referenced in EO14017, America's Supply Chains; EO14005, Made in America; 2021 NDAA; and the MIA Proclamation.](#)

Alibaba allow users to discover, evaluate, and engage with manufacturers on the other side of the world, supplier sourcing in the U.S. still generally operates like it did before the internet.

At Sustainment, we believe that the entire manufacturing ecosystem must grow together. In our evaluation of what has and has not worked in other countries and in prior eras of U.S. industrial history, we observe that manufacturing never works well in silos. There must be vibrant interaction between all tiers of the supply chain, from the large Original Equipment Manufacturer (OEM) down to the family-owned machine shop down at the 4th and 5th tier.

Our approach is to link this entire ecosystem on a single platform that delivers value to all members, resulting in quality, timely manufacturer data which can be applied to solve critical challenges at the local, state, and national level. Three broad initiatives frame our efforts:

We provide a free community experience for small-medium sized manufacturing (SMMs) suppliers who want to present their capabilities to new customers while finding, connecting, and collaborating with new partners.

We enable sourcing and supply chain professionals in both government and industry who need modern, data-driven tools to find, compare, organize, and securely engage with the best domestic manufacturing suppliers.

We accelerate the effectiveness of state, regional, and national manufacturing support organizations who need access, visibility, and connectivity into regional manufacturing ecosystems.

We began our journey working with the Department of Defense (DoD) to help solve its massive challenge of adding tens of thousands of new manufacturers to the Defense Industrial Base. We bring this experience to Colorado, along with our perspective working with other states such as Texas and a number of other manufacturers who are part of what we view as a massive movement to localize manufacturing supply chains.

EFFECTIVE SOLUTIONS THAT IMPACT HOW COLORADO COMPETES

– Glenn Plagens, Chief Executive Officer, Manufacturer's Edge

– Jennifer Hagan-Dier, Vice President and Chief Operations Officer, Manufacturer's Edge

The COVID-19 pandemic exposed vulnerabilities in critical supply chains long-ignored or overlooked by industry and policy makers at all levels. The one thing that was clear from the beginning – very few companies were prepared for disruptions, and most did not know what to do or where to start. The federal government lacked the information on critical supply chains and the industrial base necessary to coordinate a national response. States and companies, most without existing plans for such a situation, were left to fend for themselves with varied results. States, like Colorado, which acted quickly to bring together government agencies, policy makers, private industry, and organizations that support the manufacturing such as the state MEP Center, were able to leverage resources and knowledge to mitigate the damage to their state's economy. However, the efforts of these states, including Colorado, were slowed by a fragmented and divided ecosystem with duplication in services and resources and no clear understanding or inventory of who made what and where they were located.

"The COVID-19 pandemic sent shock waves across and throughout the manufacturing industry worldwide, exposing the vulnerabilities in supply chains and forcing manufacturers across the United States to rapidly identify gaps and scramble to find domestic suppliers and resources while also trying to keep their own people safe and their doors open," commented Jennifer Hagan-Dier, VP and COO of Manufacturer's Edge. "Without a coordinated federal response, states were left to address the impacts of the pandemic from lack of design specifications for life-saving PPE and medical equipment to extended factory shutdowns and delays in overseas shipments to raw material shortages to unprecedented price hikes. With a presence in all 50 states and Puerto Rico, NIST MEP and MEP Centers worked together to respond quickly to the needs of individual manufacturers and connect and coordinate across industry sectors and regions to address gaps in necessary supply chains saving businesses and lives in the process."

One of the key learnings from the pandemic is that partnership and collaboration matter. States with investments in their MEP Centers and with strong collaboration across the manufacturing industry pre-pandemic, such as Ohio, were well positioned to identify and connect small and medium-sized manufacturers with the support they needed to survive and thrive during the pandemic. For example, MAGNET, the northeast Ohio MEP, collaborated with state agencies and officials, The Ohio Manufacturer's Association, private industry, non-profits, and community groups to identify needs and respond by developing a platform like

"Craig's List" where any manufacturer, in Ohio or elsewhere, could search for supplies needed during the pandemic. With an initial investment of only \$35,000, MAGNET was able to utilize open-source technology to instantly connect small and medium-sized manufacturers and the healthcare industry to critical supplies needed to save lives and stay in business. In 2021, MAGNET leveraged the success of the pandemic collaborations to gather industry leaders from around the state to develop and launch "The Blueprint for Manufacturing in Northeast Ohio," a vision to lead the world in smart manufacturing.

As the impacts of the pandemic continue to ripple through the U.S. manufacturing industry, MEP Centers in every state will continue to serve companies in new and different ways. From helping manufacturers attract and retain talent to finding sources of capital, stabilizing their supply chains, and protecting manufacturers from cybersecurity threats, MEP Centers can and should be the "go to" for manufacturers in their states and across the country. The pandemic taught us that we are stronger together. Investments of time and money in ecosystem building increases collaboration, leverages existing resources, and provides opportunities to identify and drive initiatives addressing manufacturer's challenges in the state of Colorado. As the MEP Center for the state of Colorado, Manufacturer's Edge is partnering with OEDIT, CAMA, EDCC, and Sustainment to convene The Colorado Manufacturing Network with the goal of Identifying and connecting state and regional industry leaders and service providers to increase resiliency and competitiveness of Colorado manufacturers. Sustainment brings the technology to map and connect manufacturers and provides Manufacturer's Edge with the platform to map the resources and convene the Network. Founding partners OEDIT and CAMA are key to the success of an integrated manufacturing ecosystem and a thriving Colorado economy. It is time for us to work together for all of Colorado and be ready for whatever is next.

"I recently visited the Michigan MEP- Michigan Manufacturing Technology Center (MMTC). I was impressed by MMTC's "CENTER", a physical place where technologies are demonstrated, workshops are held, events take place and manufacturing companies can take their products and processes to the next level," commented Glenn Plagens, CEO of Manufacturer's Edge. "The most impressive thing is the leverage MMTC creates from their base federal funding and state match. This provides additional funding in excess the two combined. Not bad for a program that produces a 13:1 return to taxpayers for every dollar spent."

Colorado is in a great position to take full advantage of the growth that is happening in manufacturing. Rural communities in particular should take advantage of this trend as they were directly impacted by supply chain disruptions during the pandemic. To capitalize on this trend, Colorado's ecosystem needs to focus on our existing manufactures as they build capacity to satisfy the demand created by onshoring.