



Resilience tested

CSCMP'S ANNUAL
STATE OF LOGISTICS REPORT

AUTHORED BY KEARNEY

PENSKE

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Introduction

Welcome to the 31st Annual Council of Supply Chain Management Professionals (CSCMP) State of Logistics Report. After a solid 2019, this year's report identifies an industry initially traumatized but ultimately resilient after the COVID-19 pandemic crashed into the global and US economy in the first half of 2020. The shocked economy will shrink this year, but the adapting is already under way, a context we summarize as resilience tested.

In 2019, United States business logistics costs (USBLC) rose 0.6 percent to \$1.63 trillion, or 7.6 percent of 2019's \$21.43 trillion GDP.

Yet in mid-2020, that all seems like history. The pandemic, and global measures taken to reduce its further spread, have decimated supply chains, scrambled logistics capabilities, and destroyed huge swaths of demand. The size, shape, and timing of a recovery remain in question.

The pandemic has also highlighted the value of the logistics industry. Whether it's delivering critical medical supplies or allegedly hoarded toilet paper, logistics is essential to national security and well-being. Many of its employees were rightly labeled essential workers.

Logistics leaders have spent the past few months responding to crises—often with prescience, efficiency, and a welcome dollop of charm. But stepping back to look at a long-term big picture has been a luxury rarely affordable. That big picture, until now, has been hard to discern. This report seeks to provide it.

Some signs are optimistic. E-commerce continues to boom, amplified by the online shopping of those sheltering at home. Some carriers maintained profits despite declining volumes in 2019, suggesting a commitment to pricing discipline that may help them survive the bigger drops of 2020.

An economic slowdown damaged most sectors of the economy, including logistics. Some carriers may face bankruptcy; some shippers may face higher prices, others abundance. To get through trying times, all parties will need to make smart investments in technology and use such technologies to deepen collaboration.

Supply chains will need to become more resilient, better able to adjust to and recover from future difficulties. The shift away from single-source, cost-focused supply functions may pose new challenges to logistics—which itself is having its resilience tested in this crisis.

The shocked economy will shrink this year, but the adapting is already under way.

In this 31st edition we provide a narrative on macro-economic factors affecting logistics, insights from industry leaders, discussion of important trends, detailed analysis of each major logistics sector, and a strategic assessment of the industry. This year, we add two new sidebars that look at logistics from the perspective of the retail and automotive industries respectively. While not part of the physical report, they're available [here](#) and [here](#). As always, the report is rooted in calculations of USBLC, code-developed by Kearney, CSCMP, and a diverse set of industry partners.

Once again, Kearney is honored to partner with CSCMP and Penske Logistics in authoring the State of Logistics Report. In compiling the report, we collaborated with a long list of contributors, including but not limited to: Marc Althen, Penske Logistics; Brent Hutto, Truckstop.com; Alen Beljin, Penske Logistics; Bob Goddard, Dow; Richard Kaglic, Federal Reserve Bank of Cleveland; Mark Wallace, CSX; Jackie Bailey, Cargill; Luis Roman, Johnson & Johnson; Craig Fuller, Freightwaves; Steven Wasserman, Colliers International; Mania Flaskou, IHS Markit; and Steve Owens, IHS Markit. We thank all of them, and others too numerous to name, for sharing their time and perspectives.

We hope the data and analysis in this report helps you plan your business strategy for the remainder of 2020 and beyond. Please contact us with any questions or comments on the issues covered in the report or to suggest improvements that could make next year's edition more useful.

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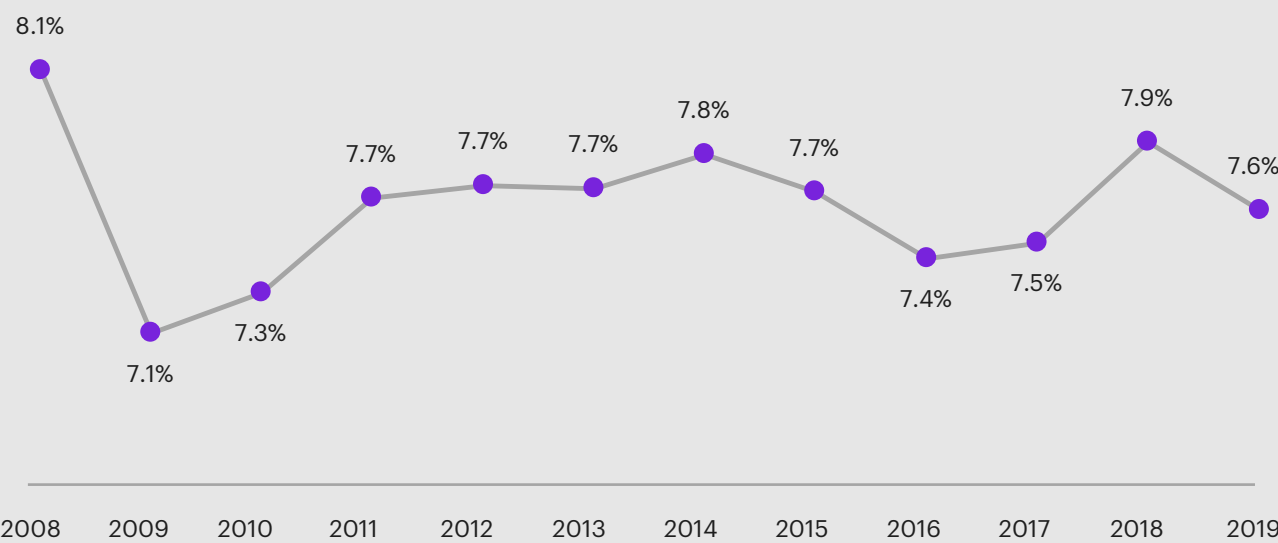
Executive summary

Steady performance, a crash, and resilience tested

At the close of 2019, the state of the US logistics industry was an unrecognized last hurrah of the “old normal.” The national economy completed a solid year with 2.3 percent growth, taking the US economy to \$21.43 trillion in GDP. The logistics industry supporting that economy grew as well, to \$1.63 trillion in expenditures. This represented 7.6 percent of GDP, down from 7.9 percent the previous year. However, 2018’s fast GDP growth and capacity shortages had driven logistics costs to the highest percentage of GDP since 2008—so 2019 felt like a return to normal (see figure 1).

Then came the COVID-19 pandemic. As this report is released, the IMF GDP forecasts for 2020 are at –5.9 percent and at 4.7 percent for 2021. Globally, countries are grappling with halting recoveries of supply, ongoing demand destruction, and secondary waves of infection—and the US is no exception. This painful and chaotic period is causing logisticians, and all who depend on them, to adapt and evolve. As they fight to survive, to operate, and then to win anew, both shippers and carriers will depend on more quickly adapting logistics capabilities.

Figure 1
In 2019, USBLC represented 7.6% of GDP—a return to normal for the industry



Notes: USBLC is United States business logistics costs. Revised or updated data sources may result in figures that differ from previous reports; see Appendix for details.
Source: Kearney analysis

Logistics leaders are normally unflappable, being accustomed to fluctuations, volatility, and even crises. But as the pandemic violently wrenched supply chains across the world, these leaders were tested by new extremes. In our view, the experience will lead to a new emphasis on supply chain resilience, which is to say that logistics will build in more options and suppleness. The pendulum that once swung toward ultra-efficient, single-source, just-in-time, and heavily cost-focused supply chains will swing back in favor of flexibility and reserve capacity to cope with uncertainty and risk. The pandemic starkly brought risks to life. That transformed the way companies think about supply chains—and the logistics that enable them. Catalyzed by ongoing trade tensions, this new resilience bias will spur reshoring and multishoring efforts and make new demands on the providers and managers of logistics capacity. The adaptations are already under way.

2019 costs increase at a slower pace overall

United States business logistics costs (USBLC) rose 0.6 percent in 2019, far less than the 2019 inflation rate of 2.3 percent (see figure 2). Although transportation costs grew by 2.5 percent, inventory carrying costs fell by 4.6 percent. This reduction in carrying costs resulted from a 16 percent reduction in the weighted average cost of capital (from 7.0 percent in 2018 to 5.9 percent in 2019). The 2.5 percent growth in transportation costs was slightly over one-quarter of 2018’s 9.2 percent growth, and below its five-year compound annual growth rate (CAGR) of 3.2 percent (see sidebar: Highlights of 2019 on page 5).

Within transportation, costs rose for motor, parcel, water, and pipeline, and fell for rail and air. Where costs fell, it was generally due to volume declines in a slowing economy, plus some easing of prices as carriers tried to sell that now-excess capacity. Where costs rose, it was often momentum from 2018 carrying over into early 2019. Some shippers signed contracts early, to avoid the premiums they’d faced among tight times in previous years. Some carriers were able to enforce pricing discipline.

Figure 2
Transportation costs fell in 2019, but were still above the five-year CAGR

US business logistics costs (\$ billion)		2019	YoY 2019/2018	5-year CAGR
Transportation costs	— Full truckload	306.7	1.4%	2.1%
	— Less-than-truckload	65.4	1.3%	1.9%
	— Private or dedicated	308.2	5.0%	3.5%
	Motor carriers	680.4	3.0%	2.7%
	Parcel	114.4	8.5%	8.8%
	— Carload	61.4	−0.2%	−2.3%
	— Intermodal	22.5	−4.3%	3.7%
	Rail	83.9	−1.4%	−0.9%
	Air freight (includes domestic, import, export, cargo, and express)	75.2	−9.7%	2.8%
	Water (includes domestic, import, and export)	47.9	3.1%	1.3%
	Pipeline	57.4	9.5%	11.4%
	Subtotal	1,059.1	2.5%	3.2%
Inventory carrying costs	Storage	149.6	6.6%	5.2%
	Financial cost (WACC x total business inventory)	168.6	−12.7%	2.6%
	Other (obsolescence, shrinkage, insurance, handling, others)	136.4	−4.6%	3.8%
	Subtotal	454.6	−4.6%	3.8%
Other costs	Carriers' support activities	59.7	1.9%	5.0%
	Shippers' administrative costs	56.4	8.5%	5.7%
	Subtotal	116.1	5.0%	5.3%
Total US business logistics costs		1,629.77	0.6%	3.5%

Notes: YoY is year-over-year. WACC is weighted average cost of capital.
Sources: CSCMP's 30th Annual State of Logistics Report (see report appendix); Kearney analysis

Among the sectors with the biggest changes:

- Air freight, down 9.7 percent, faced slowing industrial volumes, especially in the automotive industry.
- Pipeline, up 9.5 percent, was driven by pricing lags and larger volumes thanks to increased domestic oil and gas production.
- Shippers' administrative costs, up 8.5 percent, reflected a tight overall labor market and high wages.
- Parcel, up 8.5 percent, was driven by a surge in e-commerce.

In other sectors, motor carriers grew 3 percent, driven primarily by growth in private and dedicated fleets. Rail was down 1.4 percent, driven by declining volumes, especially in intermodal. Water transport grew by 3.1 percent, as pricing discipline kept rates healthy. Inventory storage costs grew 6.6 percent, as warehousing capacity remained tight. Carrier support activities likely became more efficient but also were cut back with the drop in motor carrier volumes.

Within transportation, costs rose for motor, parcel, water, and pipeline, and fell for rail and air.

Highlights of 2019

In 2019, the logistics industry exhibited very good fundamentals. Although almost nobody saw the COVID-19 crisis coming, the state of the industry in 2019 suggests that it could recover quickly.

- Logistics accounted for a reduced percentage of GDP (7.6 versus 7.9 in 2018), reflecting better overall productivity.
- Parcel and last-mile delivery saw continued growth and significant innovation.
- Road freight capacity improved, benefiting shippers.
- Railroads achieved reduced costs and increased profitability.
- Dramatically improved pipeline capacity removed bottlenecks to increased domestic oil and gas production.
- Warehouses delivered the highest square footage completed in a single quarter on record—and the market quickly swallowed it up.



Diverging by sector

Ever-rising e-commerce is redrawing the historic roles of stores, distribution centers, and the parcel delivery sector, which is evolving faster than ever. It's also forcing companies to accelerate automation. A last-mile sector now includes delivery of groceries, meals, and other items not included in the USBLC parcel figures. COVID-19 sheltering in place accelerated US consumers' desire for click-and-collect and home delivery. Those consumers' rising expectations drove shippers to devise strategies to first enable increased service levels and then minimize total cost per package. Successful shippers and 3PLs are improving asset utilization, needed to lower costs at these service levels, by segmenting products and customers with differing service-level requirements; for example, one to two hours for urban groceries versus same-day for urban apparel versus five days for rural furniture. The insights gained in this sector will advantage the leaders as they find new sources of value to move omnichannel supply chains toward profitability, leaving followers bleeding cash.

“...I view the highway as a critical competitor for growth, given the market share that trucks represent across North American freight.”

—Rail executive

Road freight, the biggest segment of US logistics spend, was already slowing down in 2019 after a torrid 2018. After two years of scarce capacity and increasing rates, the 2019 market balance tipped in favor of shippers. They regained buying power, negotiated lower rates, and secured capacity. Carriers, meanwhile, saw reduced profits and ordered fewer new Class 8 trucks. Beyond the resumption of a boom-and-bust cycle now exacerbated by COVID-19, big carriers are looking to technology investments that promise to raise efficiency. Smaller carriers, especially those in highly affected industries, must look to app-based solutions and brokers to provide access to better fit routes and backhauls.

Railroads continued to improve operations to raise profitability despite declining 2019 volumes. However, the COVID-19 pandemic slashed volumes by another roughly 25 percent, and railroads face high fixed costs to maintain their networks in their core carload business. The intermodal sector is particularly intriguing here: this year's decline follows two years of substantial growth, probably because intermodal is sensitive to price competition—in a weak year for over-the-road carriers, railroads effectively ceded a declining market. High numbers of touches and a low level of automation in intermodal keep costs high and profitability low. Given intermodal's cost and carbon-footprint benefits, shippers are keen for better prices and reliability. The railroads have noticed, with one rail executive stating, “...I view the highway as a critical competitor for growth, given the market share that trucks represent across North American freight.”

Ocean shipping faces continual disruption. In late 2018, volumes soared in anticipation of tariffs, so shippers entered 2019 with excess inventory that reduced ocean freight needs. Then the IMO 2020 sulfur regulations, implemented on January 1, created cost anxieties and pricing uncertainty. COVID-19 has now led to planning chaos. Ship and container imbalances and capacity uncertainty have driven up spot-market prices and suspended normal contracted rate negotiations as the demand picture remains clouded. While this has meant pain for the carriers, it will aid the sector's consolidation trend, which will lead to higher prices in the long term. Meanwhile, ports began 2020 seeing growing volumes and improving efficiencies, but the pandemic left them with reduced volumes, congestion, and hundreds of thousands of boxes stranded at terminals.

The pandemic dragged down air freight like no other segment. Before governments subsidized them with national stimulus packages, it was feared that most world airlines would be bankrupted. As some 48 percent of air cargo is carried by passenger planes, the effects could be dramatic. With about 90 percent of passenger routes cancelled in March and April, capacity was severely curtailed and spot rates jumped 20 to 300+ percent. But after steady declines through 2019, even more revenue per kilogram can't compensate for precipitous drops in demand. The longer-term picture is brighter: if future supply chains need to be more resilient and agile, they will likely rely more on air cargo, the most agile transportation mode.

The warehousing market continues its growth. In 2019, rents kept rising and vacancy rates stayed near historic lows. E-commerce continued to drive growth, especially in smaller, high-amenity urban warehouses. The fourth quarter of 2019 represented the highest square footage completed in a single quarter on record—and the vacancy rate barely budged. In 2020, the disruption of consumer supply chains caused by the coronavirus pandemic is expected to drive a new surge in warehousing demand, especially for temperature-controlled warehouse space, as more consumers order food online. Pandemic e-commerce is leading to an expected increase in adoption of warehouse automation solutions to keep costs and operational complexity in check even further; for example, sales of autonomous mobile robots (AMRs) are estimated to double to \$27 billion by 2025, according to LogisticsIQ. Overall, it is estimated that a 5 percent bump in safety-stock inventory will require about 750 million square feet of industrial space as companies soften their lean-inventory strategies. The rise in stock levels should spur industrial activity, given the expectation that the warehouse construction pipeline will remain full and warehouse availability will remain tight.

In freight forwarding, challengers continued to bring out new technology-enhanced offerings featuring better visibility and transparency while incumbents accelerated their adoption. In a business that one major shipper described as “designed for inefficiency with constant change and handoffs,” the leading players are striving intensely to improve the user experience and lower costs.

The pandemic tested 3PLs abruptly, with sudden stops or surges depending on the industries that they served. Most heavy manufacturing, the automotive industry, and important segments of basic chemicals came to a halt as factories closed and demand withered. The 3PLs and supply chains serving the hospitality and restaurant industries mostly stopped cold. High-tech products such as microprocessors continued to fly across the globe, still needed as inputs to crucial computers, servers, and military products. CPG and grocery demand surged as people hoarded and then shopped during shelter-at-home orders. 3PLs reported that they were able to redeploy some people and assets from the arrested to the surge-hit industries. Most shippers we spoke with reported that their 3PLs had a “we’re in this together” attitude rather than invoking *force majeure* clauses. That said, 3PLs need to keep investing and sharpening their expertise. Some shippers told us that advances in technologies (warehouse management systems, transportation management systems, track and trace) make the insourcing decision easier to take. Those shippers committed to buying talent and innovation from 3PLs reported that they were seeing incremental improvements in creativity, such as the campus model for 3PLs where multiple shippers are served from the same group of facilities, or the buildup of 3PL last-mile networks and extra cross-dock capacity that can help shippers with surges.

Consumers’ rising expectations drove shippers to devise strategies to first enable increased service levels and then minimize total cost per package.

In the pipeline sector, growing capacity came online just in time for the volumes that would fill it to vanish. Both oil and gas pipelines will see massive overcapacity in 2020 as low oil prices depress US output.

5G infrastructure promises a meeting between favorable economics and rising demand for visibility into supply chains. Within a few years, logistics providers will be able to meet that demand by automatically labelling, tracking, and recording all logistical elements, including an item's location, temperature, humidity, g-forces, and more. More users will be able to see incidents and make contingency plans. 5G-enabled automation will reduce losses and improve asset utilization through better tracking and anticipation.

The implications of the COVID-19 crisis have reemphasized the value of technology in logistics. Even providers previously hesitant to invest in shipment location tracking or electronic signatures, claiming such digital technologies were unnecessary, are now embracing them as table stakes. With rising labor costs, and despite the COVID-19-induced recession, shippers and 3PLs are looking to automation and robotics to make logistics more efficient. While serious uptake of autonomous trucking is still five to 15 years away, legions of mobile robots are already working alongside humans in warehouses. In general, winners will emerge from this crisis with more digitally savvy logistics operations, especially in the areas of creating transparency and interfaces while reducing needs for physical labor across modes and nodes.

This year's report is linked to two new deep dives, examining the state of logistics specifically for the retail and automotive sectors of the economy. Although they are not compiled as part of the physical report, you should not miss [Retail: the omnichannel supply chain](#) and [Automotive logistics: the road to success](#).

Over the past three years, these State of Logistics reports have chronicled an industry that accelerated into uncertainty and then climbed a steep grade to achieve a vista offering new ways of working to create more value. The COVID-19 pandemic recapitulates this journey in a few short months, from extreme uncertainty to hard work to new possibilities. Although few anticipated the crisis, carrier and shipper behaviors have almost universally been described as exemplary. Logisticians rolled up their sleeves instead of hiding behind their contracts. People across the industry—indeed, across the world—are coming together to face this dramatic crash and rebuild from it. Players in the logistics industry are seeing the rewards of collaboration, which now motivate them to go further with bold new solutions.

Although few anticipated the crisis, carrier and shipper behaviors have almost universally been described as exemplary.

Macroeconomics: upended by COVID-19

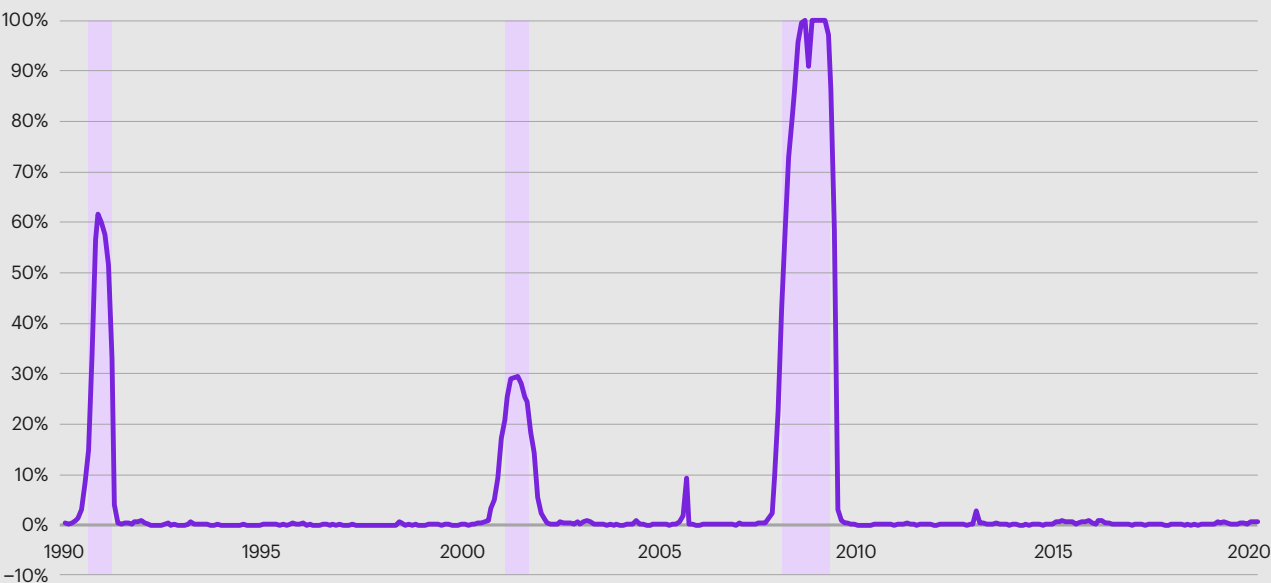
State of the economy

In 2019, the US economy reached 2.3 percent annual growth on the back of a strong labor market and consumer confidence. Expectations for 2020 were that the economy would slow but nevertheless grow at 1.7 to 1.8 percent. Then the COVID-19-induced recession ended 126 months of economic growth, the longest economic expansion in US history.

The impact on business investment and trade is profound. Containment efforts including social distancing and business lockdowns have led to dramatic business interruptions. The pandemic assumed massive proportions quickly, and the United States plunged into recession.

Just weeks before the first known US case, the St. Louis Fed chart on the probability of recession gave no indication of an oncoming recession (see figure 3). At that time, sources of optimism included solid job growth, low unemployment, and strong consumer and business confidence.

Figure 3
In January, the St. Louis Fed’s smoothed US recession probabilities chart gave no indication of an oncoming recession



● Smoothed US recession probabilities

Sources: FRED Economic Data: Smoothed US Recession Probabilities (RECPROUSM156N); Kearney analysis

Shock of COVID-19 and impact on the US economy

COVID-19 was first identified in the United States in January. By the end of March, social distancing was the norm across most US states, while most of them had implemented strict business lockdowns in an effort to curb the spread of the outbreak. These prolonged business interruptions plunged the US into a recession the second quarter of 2020, and GDP levels are expected to plummet.

Although recession estimates vary, they are all bleak. For example, Oxford Economics predicts that the economy will contract by 7 percent in 2020 before rebounding to +8.6 percent in 2021, while the International Monetary Fund projects a 5.9 percent contraction this year, followed by 4.7 percent growth in 2021 (see figure 4).

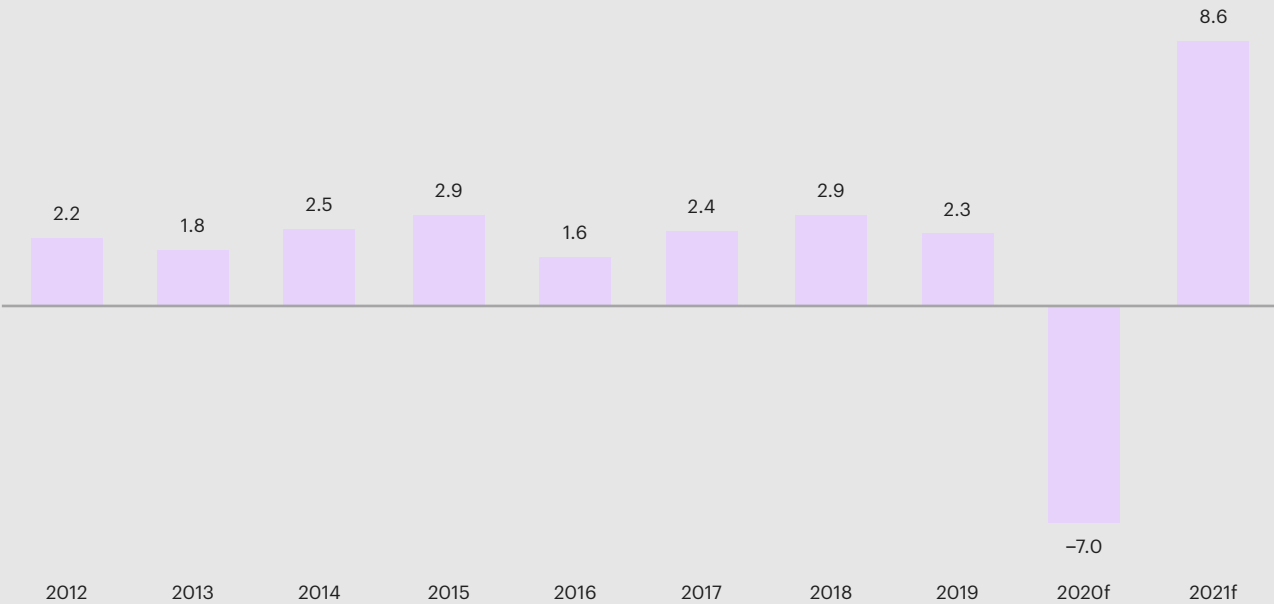
The unemployment rate was 13.3 percent in May, after a high of 14.7 in April, according to the US Bureau of Labor Statistics. The improvement, which came as a surprise, was not necessarily an indicator of future direction; quarterly forecasts released by Oxford Economics in May predicted levels at 13.2 percent in Q3 and 10.4 percent by the last quarter of 2020 (see figure 5 on page 11). Surging job losses

caused a 7.6 percent quarterly contraction in consumer spending in the first quarter of 2020, the sharpest decrease since 1980. However, the unemployment rate does not account for the decline in labor force participation and the increase in the number of those working part-time for economic reasons. When these are thrown into the mix, the underutilization rate could be as high as 23 percent. In the classic recessionary spiral, the plunge in consumer spending caused businesses to suffer lower revenues and heightened uncertainty; those businesses laid off more employees; the newly unemployed and fearing-soon-to-be unemployed spent less; and the slowdowns widened to additional industries, forcing more layoffs and bankruptcies.

The Fed approach largely succeeded in preventing a financial crisis in March 2020, when the risk of it occurring was highest.

Figure 4
US economic growth is forecast to slow

US real GDP growth (annual percent change)



Sources: Oxford Economics; Kearney analysis

Corporate profits were squeezed across the country. Business investment and trade shrank the most since the global financial crisis of 2008. The reduction of business investment and production interruptions is visible in the declining demand for electricity, for example. Broadly, electricity usage is a reliable indicator of where the economy is headed next, with data suggesting linkages between decreased use of power and lower economic activity levels. For example, in 2008–2009, electricity usage plunged along with unemployment levels (see figure 6 on page 12). Most recent state-level data confirms that US electricity demand fell by more than 7 percent between February and April 2020.

To provide a lifeline to the economy, US authorities deployed unprecedented fiscal and monetary tools, which included the Federal Reserve aggressively cutting interest rates to 0.0 to 0.25 percent in March as well as taking a number of additional monetary measures. The Fed approach largely succeeded in preventing a financial crisis in March 2020, when the risk of it occurring was highest. On the fiscal side, in March Congress adopted a \$2.2 trillion aid package that included loans for companies and local governments, as well as direct payments for individuals and families.

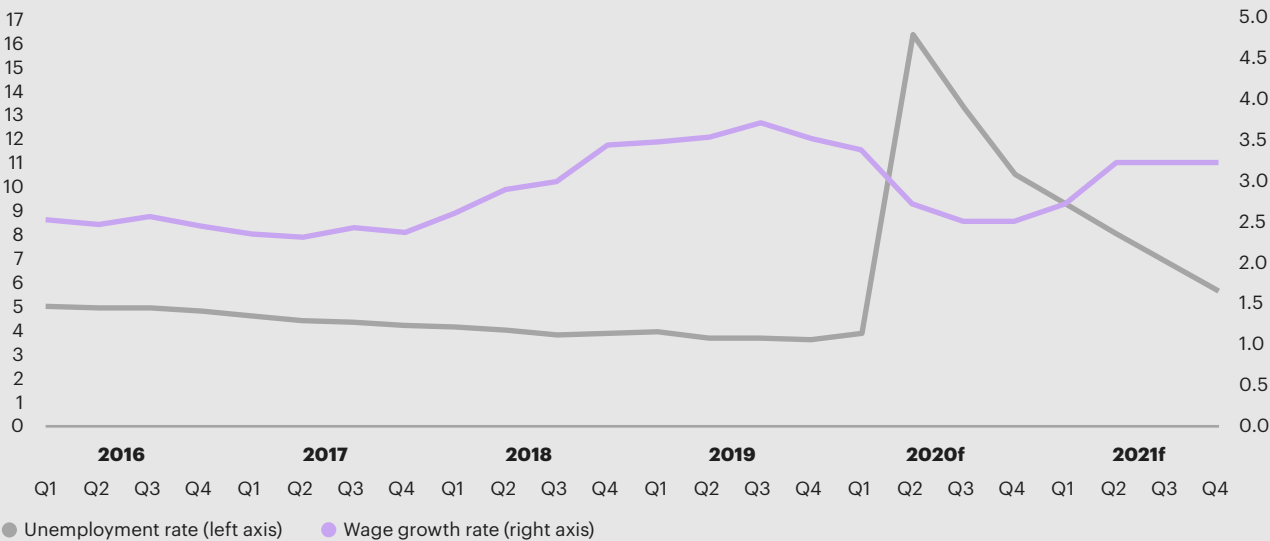
Forecast: the shape and timing of recovery

Although the US economy is expected to rebound by the beginning of 2021, considerable uncertainty remains about the severity of the recession and the timing of economic recovery.

The uncertainty arises from the novel nature of the crisis. As a global shock, the COVID-19 pandemic is more economically damaging than either a recession or escalation of trade tensions. But as a public-health event, the pandemic will recede. When it does, will sound underlying economic fundamentals result in a quick recovery? Or will reactions to the pandemic—widespread cuts in consumer spending, severe disruptions to supply chains, and a major interruption across industries—cause this recession to behave like other, sometimes persistent, recessions?

Figure 5
The pandemic caused the unemployment rate to spike

Unemployment rate and wage growth (year-over-year)



Wage growth rate includes year-over-year increases in wages for production and non-supervisory employees.
Sources: Oxford Economics; Kearney analysis

In normal times, the range of forecasts for US GDP in the current year is very small. A 1 percent rise is bad, a 4 percent rise is good, and forecasts generally sit well within that range. These are not normal times. Forecasts for Q2 GDP have ranged from -42 percent to less than -1 percent. Q3 GDP predictions are similarly broad ranging. Oxford Economics predicts 10 to 11 percent declines for Q2 and Q3, with recovery following (see figure 7 on page 13).

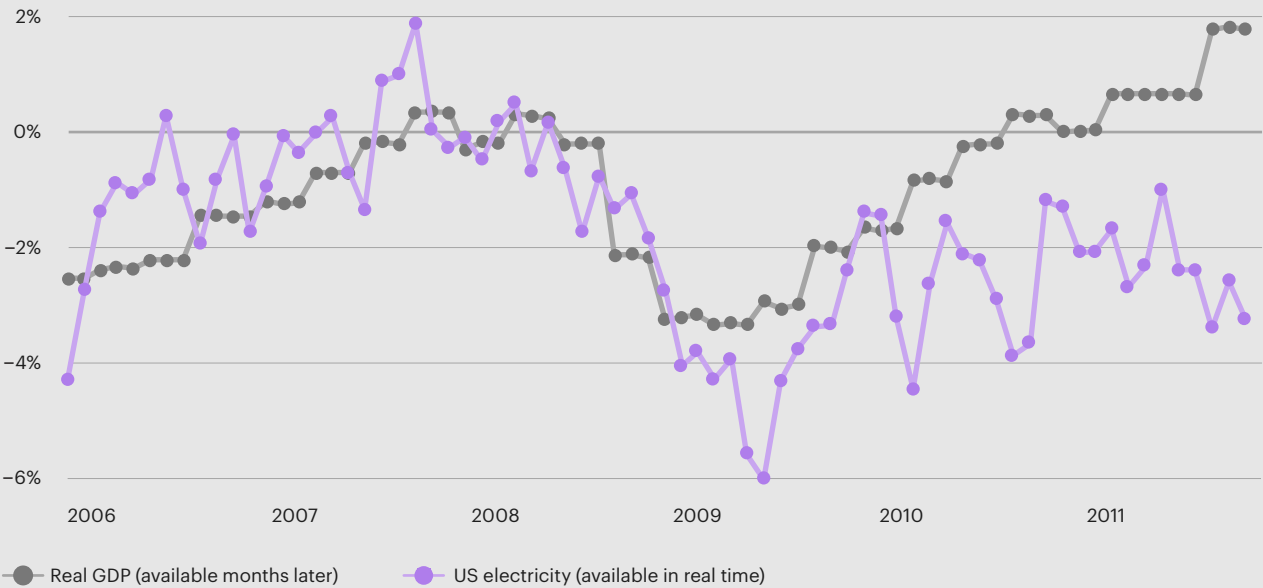
Initially, hopes centered on a V-shaped recovery, in which the COVID-19 damage is short-lived and the economy bounces back quickly. More recently, a majority of economists in a Reuters poll expected a U-shaped recovery, with a prolonged trough.

An L-shaped recovery—a slower and more painful recovery process—is also possible. If efforts to contain the spread of the pandemic don't bear fruit, requiring longer-than-expected economic lockdowns and social distancing measures, economic damages could continue into 2021 and even beyond. An 18-month downturn and a prolonged global recession would lead to a longer market correction, significantly depressed investment levels, and potentially another global financial crisis. Such a recession would likely be much deeper and longer than the post-2008 recession. Though oil prices are expected to remain low at least over the near term, any logistics benefits from these lower prices would be more than offset by the reduced global demand and production resulting from shrinking consumption levels and global trade.

When the economy starts to recover, the process will likely be uneven and staggered. As disruptions ease, some businesses will rebound strongly but other sectors will remain slow, and business investment will be bouncing back from a much lower baseline than before.

Figure 6
In 2008, electricity consumption data predicted GDP declines

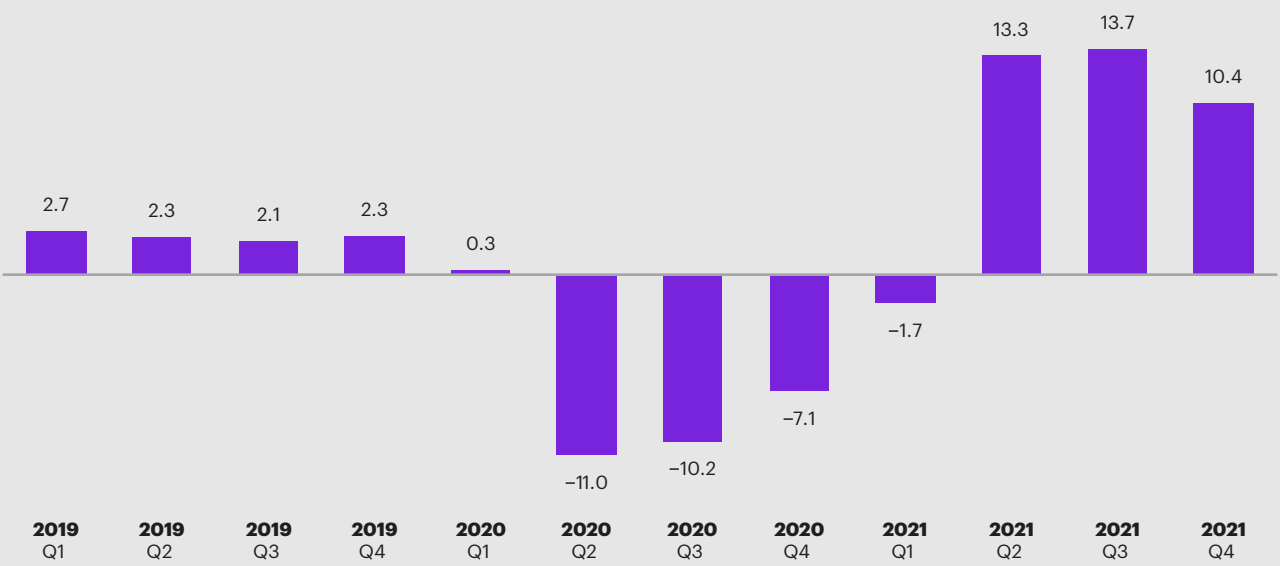
Decreasing electricity consumption forebodes a decline in economic activity



Sources: Energy Policy Institute at the University of Chicago; Kearney analysis

Figure 7
Most economists predict a U-shaped recovery

Economic growth will nosedive and then is expected to rebound
(US real GDP growth, YoY percent change)



Note: YoY is year-over-year.
Sources: Oxford Economics; Kearney analysis

It may take months or years for unemployment and wages to return to pre-coronavirus levels. The recovery may resemble that of 2009–2011, when other indicators had stabilized but unemployment levels remained high. Indeed, economic effects could last for decades. A study of European central bank interest rates since the 14th century noted that pandemics destroy more capital than wars, and the effects of pandemics on the economy are more damaging than those of wars, as the latter tend to destroy more physical assets, rather than cause more permanent behavioral economic changes. Given today’s faster global economy, those effects may be compressed in time—but even five years is a long-lasting effect (see figure 8 on page 14).¹

Consumer confidence and affected industries

The labor market weakness has caused consumer sentiment to plunge. The consumer confidence index dropped 18.1 points in early April, the largest monthly decline ever recorded. This followed an 11.9-point decline in March, sending confidence to its lowest level since 2011 (see figure 9 on page 14).

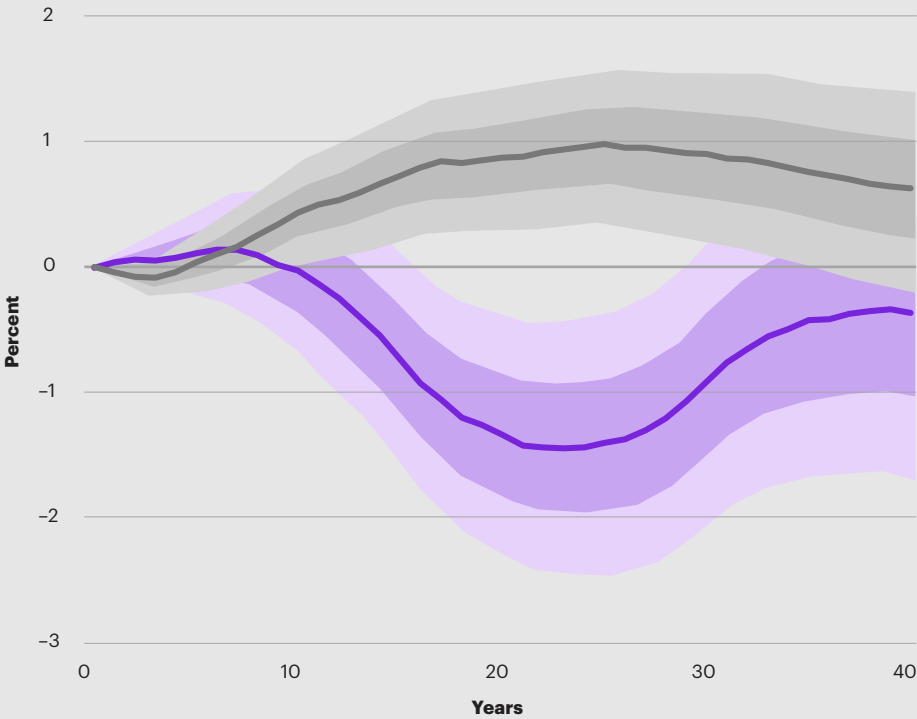
The index has two components—current conditions, which is falling almost twice as fast as it did in the 2008 financial crisis, and expectations, which is declining substantially but nowhere near record levels. Consumers apparently expect that an economic recovery will begin once the pandemic peaks.

¹ Jorda, Oscar, Sanjay R. Singh, and Alan M. Taylor. *Longer-run economic consequences of pandemics*. No. w26934. National Bureau of Economic Research, 2020.

Figure 8
Historically, pandemics have been more damaging than wars

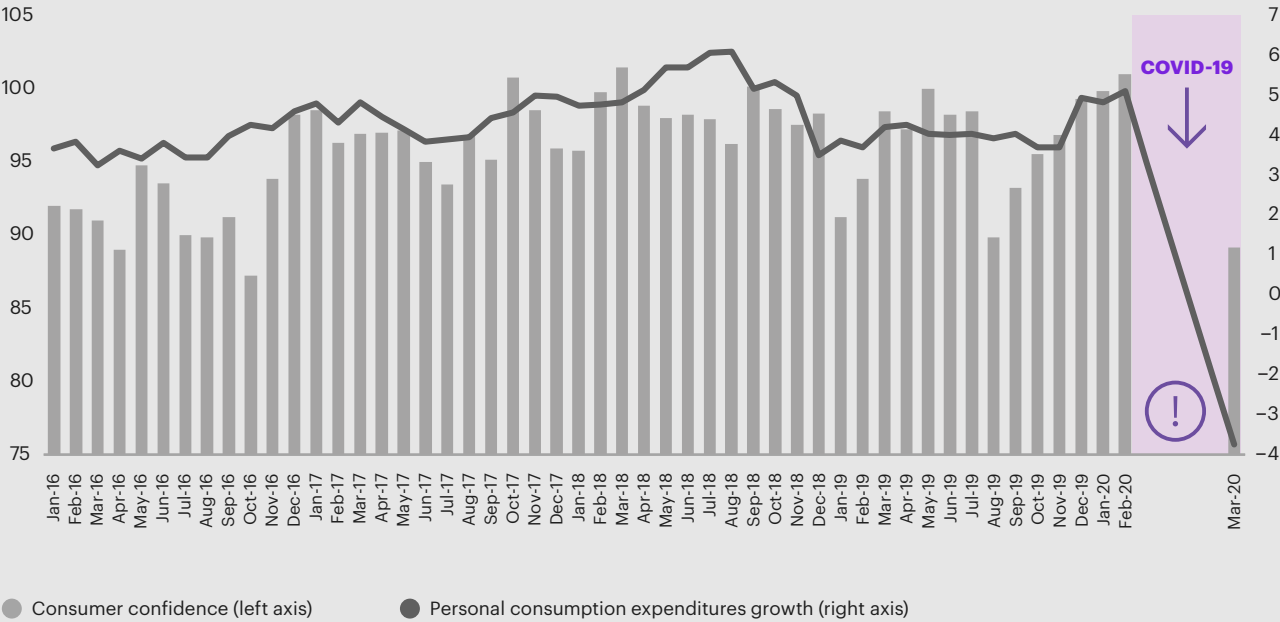
The response of the real natural rate to pandemics and to wars

- Pandemics
- Wars



Sources: Jorda, Oscar, Sanjay R. Singh, and Alan M. Taylor. Longer-run economic consequences of pandemics. No. w26934. National Bureau of Economic Research, 2020; Kearney analysis

Figure 9
Consumer confidence has plunged



- Consumer confidence (left axis)
- Personal consumption expenditures growth (right axis)

Sources: University of Michigan, US Bureau of Economic Analysis; Kearney analysis

Consumer sentiment has a significant impact on spending levels. A significant share of US consumer spending is discretionary, so lagging sentiment could mean that spending that is “postponed” during cancellations and social distancing might in fact be lost completely. Sectors that are most vulnerable to this pullback in discretionary spending include recreation services, leisure and hospitality, transport, recreational goods, gasoline, and clothing. Combined, they account for about 50 percent of consumption.

COVID-19 impact on logistics

The impact of the COVID-19 pandemic on the economy as a whole has been surprisingly variable, highly unpredictable, and ultimately destructive. That is perhaps even more true for the logistics industry specifically.

Demand has surged for groceries and e-commerce—and for their associated logistics services. Demand in other sectors, such as heavy industry, has cratered. The resulting idle trucks and distribution center capacity can only partially be redirected to the booming sectors—even with their renowned agility, logistics providers cannot reconfigure all their capabilities and relationships on the fly. Coordinating the movement and direction of logistics, particularly during a disruptive event such as COVID-19, can be particularly challenging and can frequently result in inefficient resource deployment.

Some of the biggest effects have been in international trade. Exports from China started vanishing in January. In Q1 2020, Chinese exports to the United States were down by almost 24 percent, while overall bilateral trade decreased by more than 18 percent. With trade representing 27 percent of US GDP, the effects could be particularly damaging. US–China trade tensions are unlikely to abate in the near term, which will accelerate reshoring and multishoring.

Air passenger traffic soon plummeted as well—and 48 percent of air cargo travels in the bellies of passenger planes. With capacity falling even faster than demand, air cargo prices spiked. In a similar effect for sea transport, carriers cancelled sailings, reducing capacity and raising prices.

US–China trade tensions are unlikely to abate in the near term, which will accelerate reshoring and multishoring.

Although the COVID-19 implications are still taking shape, its most lasting effects are likely to be accentuations of existing trends. For example:

- **E-commerce has arrived.** Social distancing trained many more consumers to order many more goods online. The logistics of e-commerce differ greatly from the logistics of bricks-and-mortar retail—so as the pandemic hurries in this new era, it transforms the industry.
- **Shippers will value resilience.** A pendulum that once swung toward ultra-efficient, single-source, just-in-time supply chains will swing back for flexibility to avert risk. As the pandemic starkly brings risks to life, it transforms the way companies think about supply chains, and the logistics of connecting them. This new resilience bias catalyzed by ongoing trade tensions will spur [reshoring efforts](#).
- **Consumers remain insatiable.** Consumers love getting their products as fast as possible, forcing retailers to figure out how to satisfy them. As the pandemic spikes at-home delivery—of meals and groceries, in addition to traditional parcels—it forces companies to think about their delivery chains, and the logistics of getting items into consumers' hands.

The COVID-19 pandemic morphed into political, economic, and social crises. The resulting economic dislocations are causing great pain. For the logistics industry, the pandemic's effects are both wrenching and transformational. The rest of this report examines how.

For the logistics industry, the pandemic's effects are both wrenching and transformational.

The logistics industry in 2019

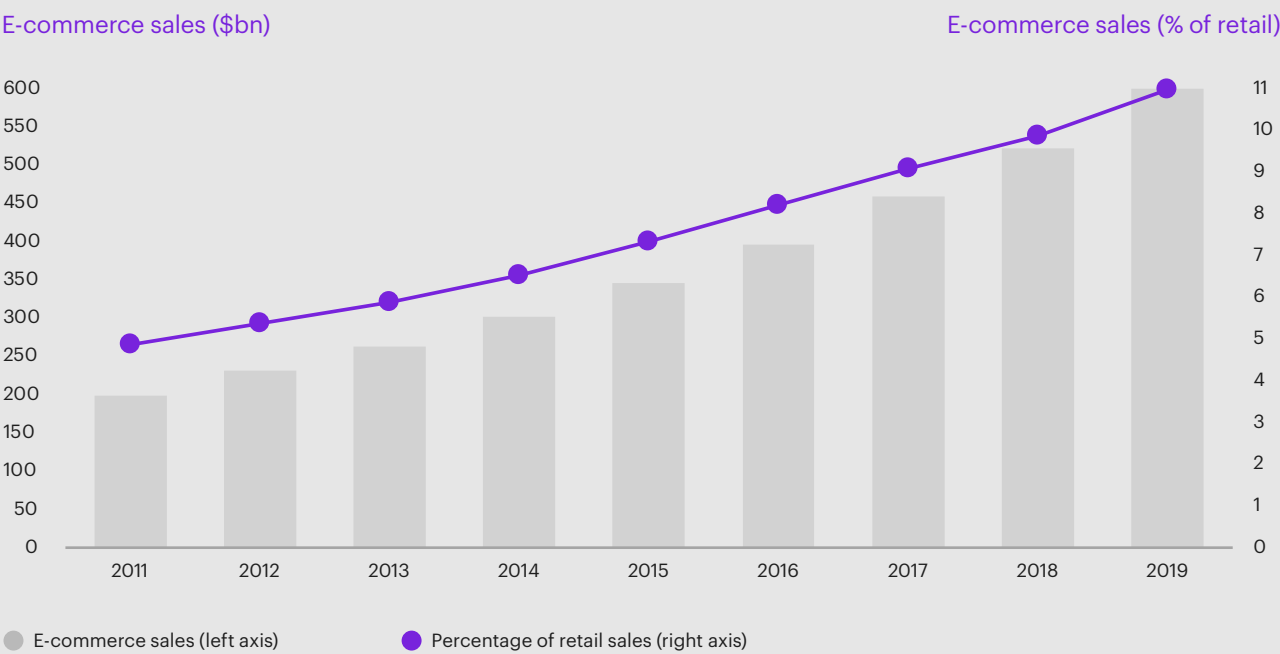
Parcel: last-mile segmentation

The US parcel delivery sector grew almost 9 percent in 2019, to a \$114 billion market. That growth is consistent with its five-year compound annual growth rate (CAGR) of 8.8 percent. Looking to the future, the sector’s growth and challenges all come in the last mile. Last-mile experimentation that reached peaks during the COVID-19 pandemic will impact companies and emerging capabilities for years going forward. Particularly, as the COVID-19 pandemic accelerates home delivery adoption, innovative solutions for the last 50 feet of the delivery journey will become vital to both enhance the customer experience and minimize last-mile costs.

E-commerce drives the last-mile expansion. US e-commerce sales grew almost 15 percent in 2019, to \$600 billion. That accounted for 11 percent of total US retail sales, an increase of 11 percent from 2018 (see figure 10).

In this context, COVID-19 is a shot of adrenaline. It will increase e-commerce adoption across growing categories such as grocery and essential household items, expedite the growth of the last-mile delivery market, and improve scale and route density to reduce last-mile delivery cost structures. The increased costs and competition—as well as the now-demonstrated need to be able to rapidly respond to unpredicted, large-scale events—will force shippers and carriers to think about up-front investments in modular networks and resilient supply chains.

Figure 10
E-commerce sales grew almost 15% in 2019 and accounted for 11% of US retail sales



Source: Kearney analysis

Chasing the ever-more-demanding customer

The last-mile delivery landscape is fast changing and complicated but driven by a single constant: rising customer expectations. The era of “shipping in three to five business days” only is over. For example, grocery deliveries and pickups (a \$33.4 billion market in 2019, up 28 percent) is moving toward same-day and ultra-fast (defined as less than two hours from click to delivery). Although vast numbers of consumers still enjoy in-store shopping, the ones who explore alternatives have exacting requirements for the convenience of that experience.

Increased customer expectations are driving shippers to devise strategies to enable increased service levels at a minimized total cost per package. For example, in September 2019 Walmart launched its Delivery Unlimited service, which charges customers \$98 annually for unlimited, same-day delivery of fresh groceries from 1,600 US stores. Then in November 2019 Amazon eliminated its \$14.99 monthly Amazon Fresh subscription fee, thus expanding one- to two-hour grocery delivery to 2,000 US cities.

But groceries are merely one example. Across the entire delivery market, retailers and shippers are offering customers lots of options in delivery speed and type (night or weekend, locker, pickup). For example, both FedEx and UPS launched year-round (not just peak-season) seven-day-per-week delivery in 2019, a significant service-level increase. Meanwhile, Amazon and Walmart have launched pilots to cut same-day delivery times and deliver straight to the refrigerator, respectively.

It can be tempting to handicap the specifics of the vast number of creative approaches to operations, collaboration, and customer engagement. But in a bigger picture, the race comes down to three measures of delivery quality:

1. **Delivery capacity.** When I order an item, even if you have forward-deployed your inventory to have it sitting on a nearby shelf, you may still lack the labor and other assets to get it to me within my desired delivery window. To meet my window, you’d need to overpay for excess capacity. Being always available is extremely costly.
2. **On-time delivery.** As a consumer, I require end-to-end process visibility through near-real-time notifications and a picture upon delivery. Furthermore, I must receive my delivery within your original promise window. Your success requires a network designed to repeatedly deliver on my expectations.

3. **First-time delivery success.** If I find defects in the delivery—damages, missing or incorrect items or packages, or delivery to the wrong location—it’ll cost you. Delivery quality defects result in customer service contacts, reverse logistics, and potential loss of future business or expenditures such as promotional offers to retain it. Because they infuriate me and increase your cost of service, there is no room for defects. Moreover, with the accelerated transition to e-commerce fueled by the COVID-19 pandemic, delivery accuracy becomes an increasingly important driver of customer experience and minimizing cost headwinds.

As these measures show, increasing service levels to satisfy the rising expectations of customers is not merely a temporary loss leader experiment. It’s risky, expensive, and hard to retreat from. Can shippers afford these rising costs?

How to pay for it all

Many shippers are looking at alternative cost recovery models. For example, Amazon charges Prime members \$119 per year. Many of its delivery options also have a \$35 free-shipping threshold. Walmart and Target/Shipt have similar strategies.

Large carriers are improving efficiency by increasing scale and route density. In February 2020, FedEx increased its delivery density across growing residential regions by merging its premium air freight business unit, FedEx Express, and its standard ground delivery business unit, FedEx Ground. In July 2019, UPS launched UPS Access Points at more than 6,000 CVS Pharmacy locations (it now has 48,000 global Access Points). During the 2019 holiday season, UPS offered customers up to \$35 in rewards to try such alternate delivery locations—because this network helps UPS improve route density.

Amazon also launched alternate delivery options in 2019, including Amazon Counter partnerships with retailers such as RiteAid, GNC, and Kohl’s, and Amazon Day to consolidate consumer deliveries on a single day of the week. These innovations highlight how Amazon is using programs such as Ship with Amazon and Fulfilled by Amazon to position itself as a competitor to transportation and logistics providers.

As large e-commerce players continue to grow their capabilities and presence within the last-mile delivery space, carriers need to closely evaluate shipper relationships, because simply increasing scale does not directly translate to profitability. For example, although USPS package volume has more than doubled since 2010 and has been the primary source of revenue growth, this increase in scale has not been sufficient to overcome the financial losses experienced. To ensure profitability, carriers must develop advanced analytical capabilities to understand the differentiated cost per package impact by shipper, and establish strategic partnerships accordingly.

Shippers can respond with segmentation

Amazon has captured almost 39 percent of US e-commerce sales; second-place Walmart has just 5.3 percent. Given Amazon's constant pursuit of more and faster delivery options, a shipper might be tempted to assume that all categories and product segments must be delivered within two days—or faster. But such a blanket strategy is a recipe for ballooning expenses. Large retailers should instead segment products and customers specific to industry demands. When working backward from your customers' needs, you'll discover differing service-level requirements, such as one to two hours for urban groceries versus same-day for urban apparel versus five days for rural furniture.

To properly segment service levels for your specific situation, you must comprehensively understand your product and customer segmentation, customer sentiment, total cost per package or order, and the technological investment required to enable new capabilities. Armed with these insights, you can [devise a last-mile delivery strategy](#) that aligns to your customers' expectations.

Cost implications vary by strategy. For example, moving from six-day to five-day delivery has minor cost implications compared to shifting to two-day, same-day, or ultra-fast delivery. So, what incentives might entice customers to choose slower delivery speeds? Which cost recovery models (for example, subscriptions, minimum order thresholds, fees for faster delivery) would they embrace? And what are the cost implications of forward-stocking inventory within a faster delivery footprint?

Shippers may want to collaborate with a carrier on a hub-and-spoke network of mobile fulfillment centers to bring crucial inventory and pre-ordered volume closer to delivery destinations. Another way to defray costs is to enhance late-stage customization capabilities to create bundles for customers—for example, providing twin-packs or other bundled items to assist retailers in increasing overall basket sizes. Finally, shippers may need to rethink carrier mix to better accommodate unplanned demand and reduce operational risk.

For small to medium-size businesses (SMBs), the decisions become more difficult because delivery networks require such large capital investments. But with sufficient knowledge of customers, smaller shippers may be able to focus on a crucial geographic area. Likewise, due to the costs of forward-stocking inventory, it can be wiser to use a third-party logistics provider (3PL) or pay extra premiums for expedited service from a local distribution center.

Carriers face up-front investments

Carriers face inevitable cost increases. There's no other way to meet the increase in expected service levels. Nevertheless, as a carrier, you can achieve profitable growth through a balance of scale, density, and mode choice. As noted above, alternate delivery options (lockers, retail stores, customer incentives, delivery consolidations) can increase density. Furthermore, you might seek asset-light transportation for urban areas—as in Amazon's experiments with walking and biking deliveries in New York City.

To better adjust to demand spikes such as that caused by the COVID-19 pandemic, you may want to invest up front in a mix of delivery options and sourcing alternatives, such as crowdsourcing and third-party providers. Within this arsenal, perhaps the best at ramping up quickly is a crowdsourced delivery program with a large and responsive supply base.

Meanwhile, you can achieve greater scale and route density by becoming the carrier of choice for one or more strategic large shippers. But such positioning may require you to show capabilities in real-time exception management, automated real-time capacity management and route assignment, real-time customer delivery visibility mechanisms, autonomous drone and vehicle delivery solutions for sprawling residential areas, and real-time rerouting based on live traffic data. Given how much money has been hemorrhaged in this space, it may be best to be a fast follower rather than trying to define the bleeding edge.

Motor carriers: overcapacity favors shippers

In trucking, as in many other logistics sectors, the COVID-19 pandemic shook up an industry that was coming off an already challenging year. The pandemic's first-order effects were hectic, with a sharp increase in demand in select industries spurred by stay-at-home policies and panic buying, while demand withered in other industries as businesses closed. By contrast, the second-order effects—surrounding a potential resulting recession—could be devastating.

Market overview

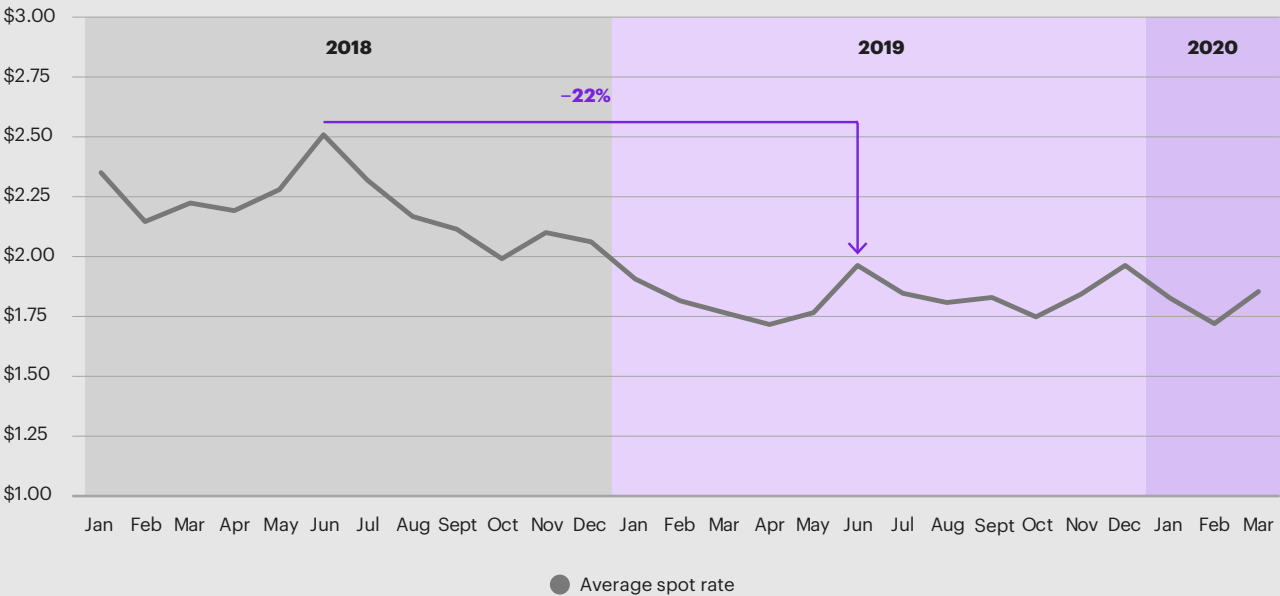
After years of scarce capacity and increasing rates, the 2019 market balance tipped in favor of shippers. They regained buying power, negotiated lower rates, and secured capacity. Carriers, meanwhile, suffered from profitability concerns.

USBLC data show full truckload (FTL) and less-than-truckload (LTL) costs increasing by 1.4 and 1.3 percent, respectively—both less than the 2019 inflation rate of 2.3 percent. A 5.0 percent increase in the costs of private and dedicated fleets—where contracted rates lag those in the spot market—drove the overall motor carrier sector to a 3.0 percent USBLC increase.

Freight rates dipped year over year for six months straight. Prices on trucking's spot market were down 22 percent in June 2019 compared with 2018, according to online freight marketplace Truckstop.com (see figure 11).

Figure 11
Spot rates fell 22% YoY in June

Spot rates: dry van



Note: YoY is year-over-year.
Sources: Truckstop.com; Kearney analysis

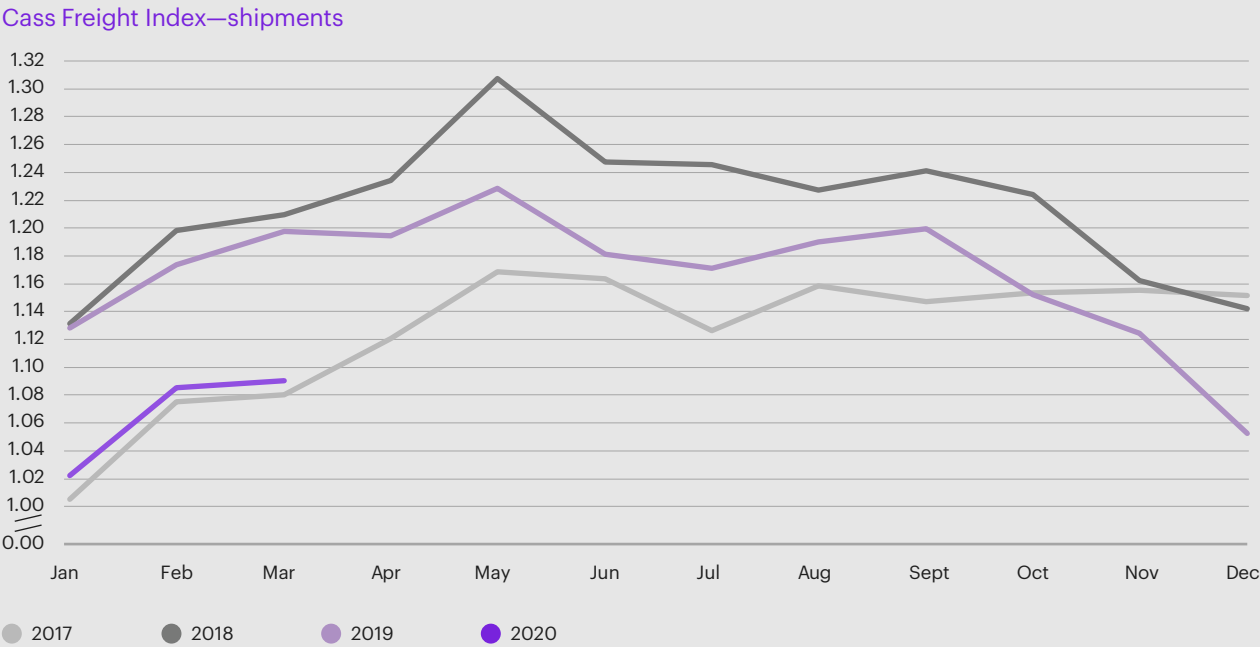
The reason? Demand declined while supply increased. Retailers and manufacturers moved less cargo in 2019 than the previous year, according to the Cass Freight Index (see figure 12). On the spot market, overall load posts fell by 27 percent from 2018 to 2019, according to Truckstop.com.

Meanwhile, supply increased because carriers invested their 2018 profits into record orders for new equipment. Orders for Class 8 trucks increased 66 percent in 2018—those trucks entered the marketplace in 2019 (see figure 13 on page 22). As carrier finances deteriorated through 2019 and early 2020, carrier investments in new assets dropped dramatically, and few new trucks will enter the marketplace in late 2020 or early 2021. Depending on the magnitude of economic recovery, this could potentially result in a capacity crunch in the second half of 2021.

One key measure of available capacity is the spot market load-to-truck ratio. In mid-2018, when prices were at their highest, the load-to-truck ratio was more than 60. This metric then spent much of 2019 below 30 (see figure 14 on page 22). In March 2020, the ratio shot up to 46, reflecting the demand from consumers stocking up at grocery stores and pharmacies. But as conditions stabilized in April, it returned to roughly 2019 levels. Likewise, dry van rates spiked in March but have dropped since.

Behind these broad numbers are complex shifts in types of trucking. For example, the COVID-19 crisis accelerated demand for groceries and home consumables while slowing manufacturing demand. It also accelerated a consumer shift from stores to e-commerce, which means fewer warehouse-to-store deliveries and more traffic in and out of fulfillment centers.

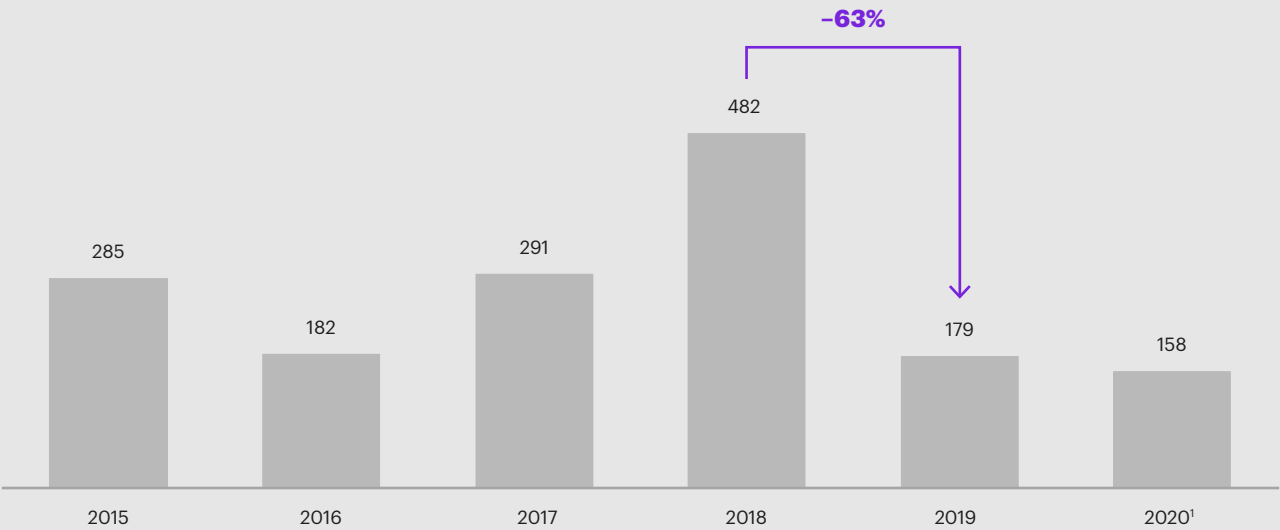
Figure 12
Retailers and manufacturers moved less cargo in 2019 than the previous year



Sources: Cass Transportation indexes; Kearney analysis

Figure 13
Many carriers invested their 2018 profits into record orders for new equipment, resulting in a growing supply of trucks entering the market in 2019

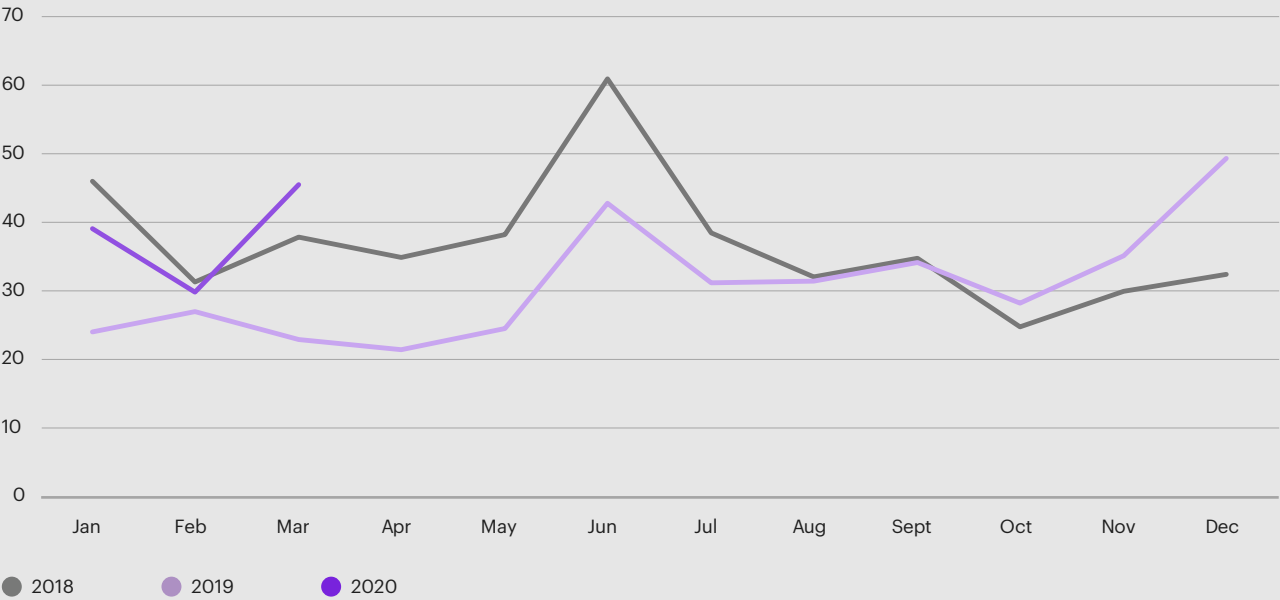
Class 8 net orders
(thousands)



¹ Annualized, based on January–March 2020
Sources: FTR Associates, NAFTA; Kearney analysis

Figure 14
Capacity opened up in early 2019 as new truck orders entered the market and demand eased

Load-to-truck ratio: dry van



Sources: Truckstop.com; Kearney analysis

Carriers in peril

The economic fallout of the COVID-19 crisis will affect carriers differently depending on their markets (for example, farm-to-grocer versus cross-border auto parts) and their region (given unequal distribution of COVID-19 effects and recoveries). Small to medium-sized carriers with a tight list of customers in highly affected industries will be hit the hardest. Considering that more than 90 percent of carriers own fewer than six trucks, most carriers will need to think strategically to survive the industry turmoil. Although recent government loans have provided a short-term safety net to aid smaller carriers, certainly a longer-term solution is needed.

Carrier profitability had already suffered from 2019's falling rates. In just the first half of 2019, 640 carriers went out of business, more than double the trucking failures for all of 2018, according to the *Wall Street Journal*. The bankrupt carriers cited challenges including falling rates and demand, increased tariffs and trade tensions, increased insurance costs, and increased cost of labor to retain drivers. The deeper a COVID-19-induced recession, the likelier this trend is to accelerate. Thus, as a carrier, you're justified in putting all of your chips on short-term survival. If you can make it through the next six to 18 months, other carriers will drop out, capacity will tighten, rates will rise, and your longer-term outlook will be more stable.

How should carriers chart a course forward? If you are seeking to manage risks amid upcoming uncertainty, you should look for ways to improve your profitability by increasing your asset utilization, cutting your internal costs, or diversifying your revenue mix.

— **Asset utilization.** One approach to efficiency is to stay focused on a predetermined network, aligning shipper commitments to keep paid miles up and drivers happy. Focusing on asset utilization and prioritizing loaded miles means that you may not want to overcommit capacity to big shippers. You should analyze your customers to understand which are the most profitable and cohesive with your network—prioritize these lanes. An alternative approach is to take advantage of freight marketplace apps such as JB Hunt's Carrier 360, CoyoteGO, and Uber Freight to monetize your empty miles, without worrying so much about the yield. This can help quickly fill in holes in your network. When evaluating customers, you can use these apps to monitor volume on compatible lanes to increase opportunities for future backhauls. Smaller carriers should pay particular attention to these platforms—as they gain critical mass, they may be able to fill your entire operation, eliminating your other customer acquisition costs.

- **Costs.** Given continued struggles for over-the-road (OTR) trucking, it's time for carriers to fundamentally change their thinking on ways to lower their cost to serve. A well-thought-out technology strategy and commitment to technology investment (targeted at core elements of the cost equation) will be crucial to shifting carriers' cost curves. Further, the resulting improvements that technology delivers for operational efficiency can have favorable knock-on effects for traditionally high "fixed" costs such as driver recruitment and driver turnover.
- **Revenue mix.** You can diversify your customer mix to rely more on fluid, rapid-response e-commerce flows and less on traditional, scheduled, retail and industrial flows. Additionally, if you currently rely primarily on one-way contracts, you could expand your dedicated fleet offering to develop a more predictable revenue stream and create stronger partnerships with your customers. For example, JB Hunt's long commitment to growing its business mix, including increasing its dedicated business, drove its 2019 revenue and profit growth despite weaknesses in its traditional truckload segment.

Small to medium-sized carriers with a tight list of customers in highly affected industries will be hit the hardest.

Shippers need resilience

After years at the mercy of carrier price increases, shippers might be tempted to rejoice at carrier distress, hoping for lower prices. However, the situation brings two types of risks. First, any given carrier could go bankrupt. So, if you're a shipper, you need to focus on resilience. You can manage risk by diversifying your supply base, by deepening your routing guide, and even by tracking the key financial metrics of your logistics providers.

Second, although short-term rate pressure benefits you, it also decreases the likelihood that cash-strapped carriers will invest in their fleets or increase capacity. As the economy recovers, capacity will again tighten, and rates will rise. The longer the post-COVID-19 recession, the tighter the ensuing capacity crunch. You can manage your exposure to this future risk through efficient operations, including increased tender lead time and improved forecast accuracy. Indeed, the lessons of the 2018 capacity crunch—becoming a shipper of choice by investing in your yards and docks and improving your loading hygiene—can also help you in today's climate. If you can help carriers reduce last-minute orders and improve delivery velocity, they can plan and deploy their assets more effectively, thus producing more profitable loads and ultimately providing you with better service.

If you're a shipper experiencing growth in a world of social distancing (for example, consumer staples, groceries, essential medical, pharmaceuticals, high-tech, and telecom), you will be particularly interested in future-proofing to grow sustainably. You want to set up your supply chain to easily adapt to market changes. Evaluate your carrier relationships and build strategic partnerships with carriers that will invest in your network, driving profitability and enabling sustainable growth for both parties.

By contrast, if you're a shipper experiencing slowdowns, you will be particularly interested in opportunities to rapidly reduce short-term logistics costs. In addition to signing contracts while rates are low, you can take advantage of strategic levers, for example by launching sourcing programs to diversify your supply base, reevaluating your carrier and mode strategy, and optimizing your routing capabilities to get the most out of your resources. For shippers with private or dedicated fleets, one way to do this is by investigating shared-use networks, partnerships that match your assets with other shippers' networks to identify backhaul opportunities.

Ain't seen nothing yet

The COVID-19 crisis and the shift to e-commerce have resulted in fast-moving, sometimes-unexpected changes to the trucking market. Yet behind these changes loom slower, distant, more transformative revolutions.

In the medium to long term, autonomous vehicles (AVs) and electric vehicles (EVs) are coming. Carriers need a well-defined investment strategy. The largest carriers and select shippers are making investments across a variety of AV and EV start-ups such as Waymo, Embark, and TuSimple. Their goal is to secure access to technology and manufacturing capacity as the technology matures, especially for emerging segments such as last-mile delivery. Meanwhile, early stepwise adoption of AV technology will help transport freight more safely and efficiently.

In the medium term, technology can help all players improve utilization and day-to-day execution. For example, companies can look to new technology solutions to move from static routing to dynamic routing. As computing power increases, historic challenges to on-demand routing will be overcome. Companies will gain unprecedented ability to match lanes in real time. In another example, companies can adopt platforms to enhance daily operations. Leading large-scale carriers such as JB Hunt and Schneider have adopted technology to improve driver productivity and improve visibility for customers. Tech companies such as FourKites, Shipwell, and Project44 have developed platforms to support customer and driver connectivity, enabling better planning for shippers and making it easier to do business with carriers.

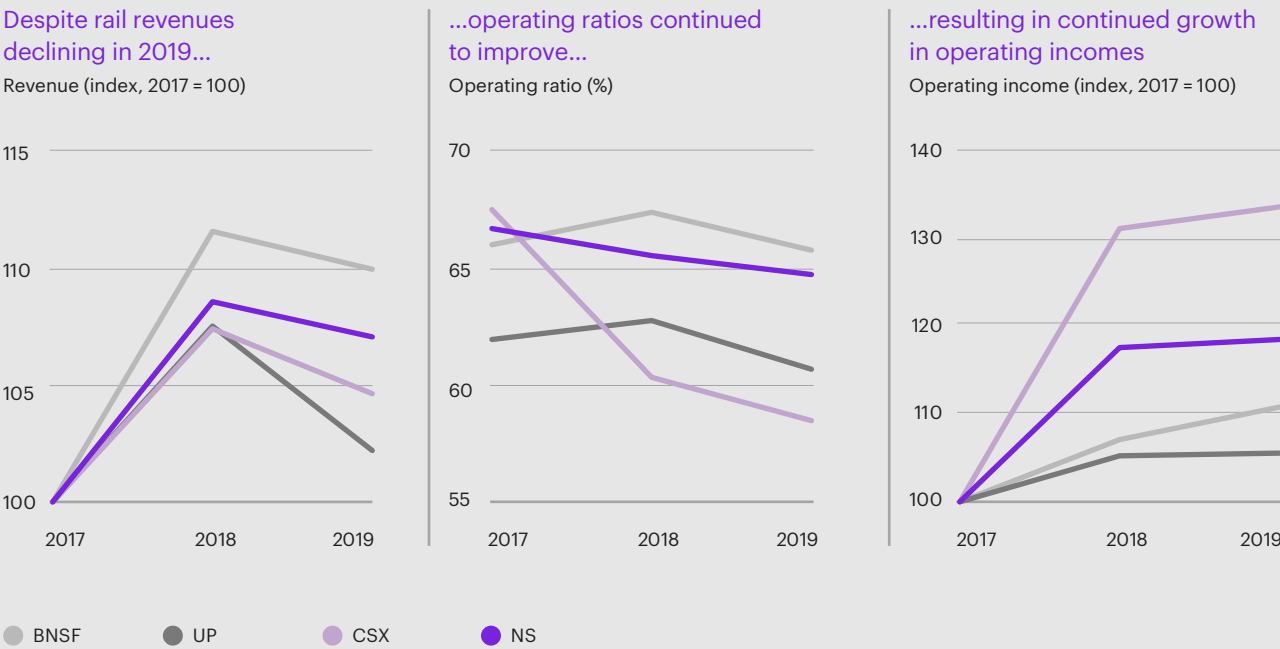
For years, the power of technology to transform trucking has been on the horizon. Recent events and trends have justifiably focused the sector's attention on maintaining liquidity during more pressing near-term crises. But as industry players chart a path to the future, they will still gain from understanding and taking part in such longer-term visions.

Rail: volumes down, new growth needed

Revenues for railroads fell in 2019, as the sector’s USBLC figures shrank by 1.4 percent. However, thanks to short-term actions to manage profitability, most railroads were able to continue growth in operating income (see figure 15). Although railroads came out ahead against weak demand last year, the COVID-19 pandemic has led to a precipitous drop in 2020 volumes, with year-over-year rail traffic down by 25 percent. This substantial reduction in volume will clearly hurt short-term revenues, but less traffic (and thus higher network speeds) should give railroads the opportunity to improve intermodal service and target longer-term growth by capturing more volumes from trucking.

The 2019 volume decline resulted from an industrial recession through much of the year, with the biggest decline coming in coal (see figure 16 on page 26). In recent years, steady increases in intermodal volumes, especially from Asia-sourced products arriving on the West Coast, have been the largest single contributor to growth, although at lower margins than other cargoes. However, weak truckload pricing in 2019 and the recent softening of consumer spending led to sharp intermodal volume declines that accounted for much of the overall 2019 railroad volume loss. Because high numbers of touches and a low level of automation make intermodal already one of rail’s least profitable lines, it’s hard for railroads to defend these volumes through price cuts. In effect, the structure of the intermodal market gives its quantities a double-boost when trucking capacity is tight (as during 2018), and a double whammy when conditions ease. This year, railroads largely ceded a declining market.

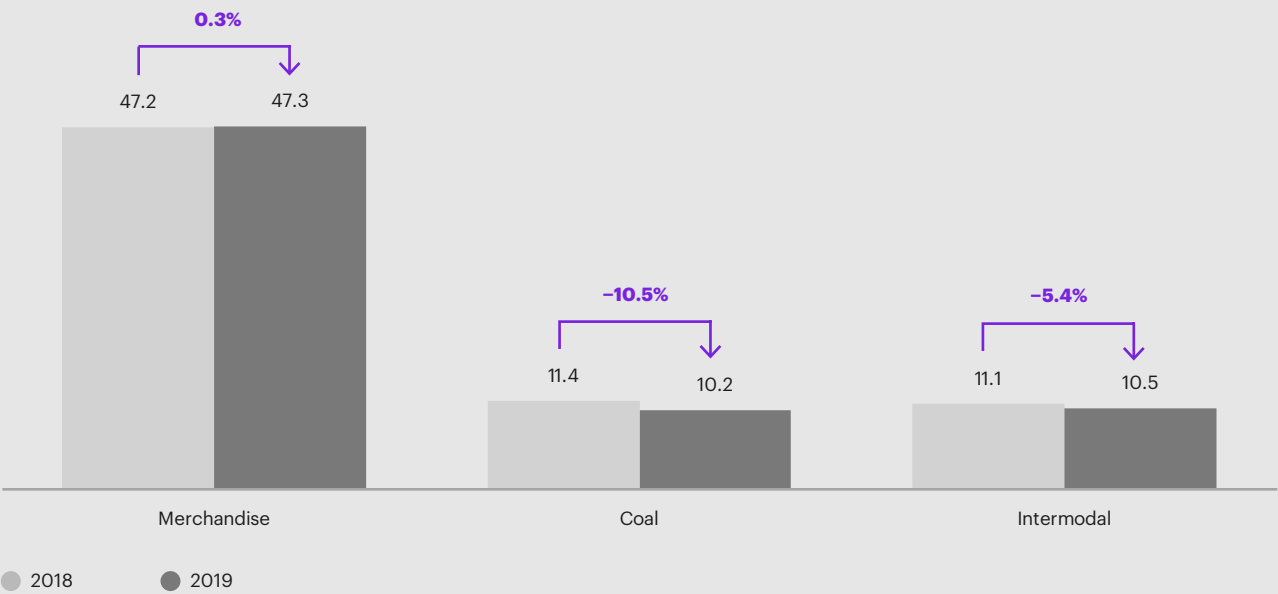
Figure 15
Most rail companies improved productivity and profits in 2019, despite declining revenues



Sources: Railroad 10K reports as published on investor relations website; Kearney analysis

Figure 16
Declines in commodity volume, particularly coal, drive the decrease in overall railroad revenue

North American Class I railroad revenue by commodity type (\$ billion)



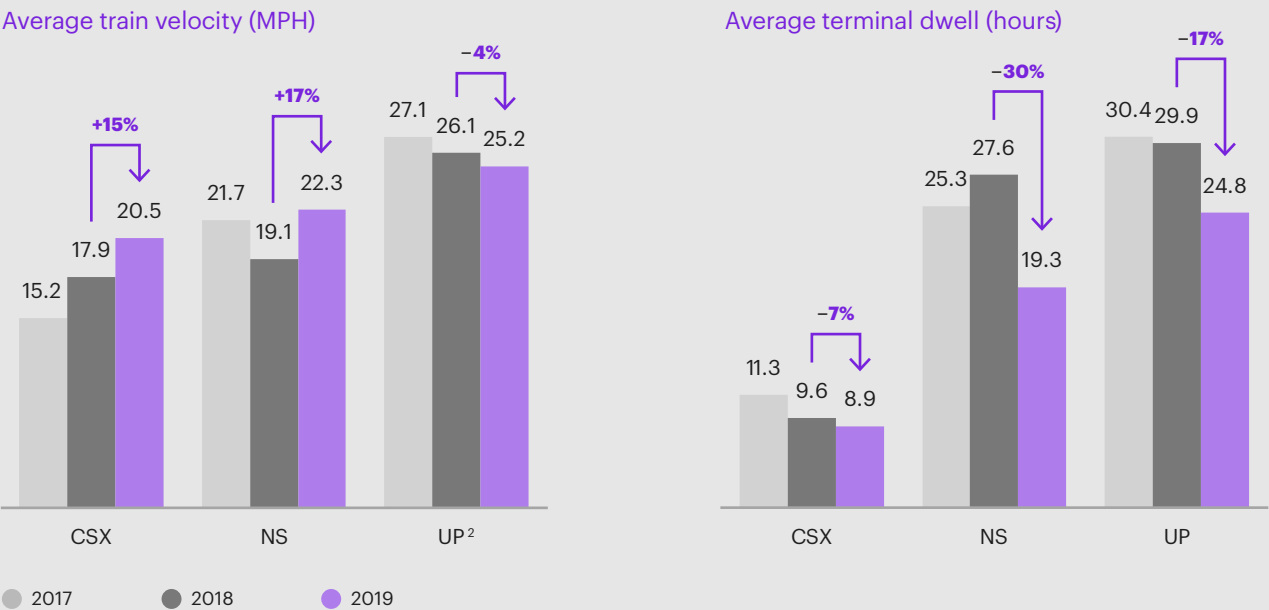
Sources: Railroad 10K reports as published on investor relations website; Kearney analysis

Profits despite declining volumes result from improvements in operating ratios. CSX has continued to make substantial inroads in reducing operating ratio through traditional precision scheduled rail-roading (PSR)-style network optimization, but some large networks are still in the early stages of achieving more competitive operating ratios. Most railroads made progress between 2018 and 2019 on key operating metrics such as velocity and terminal dwell (see figure 17 on page 27). Although early PSR implementations generated customer service complaints, key measures such as on-time arrivals and departures improved in 2019.

As the COVID-19 situation has evolved, the railroads have responded to drastically reduced volumes with PSR-like maneuvers. Moving quickly to reduce costs, they have parked locomotives, furloughed employees, and restructured services and schedules. In the longer term, these levers are likely approaching their limits; the next generation of operating ratio improvements will likely have to come from further integration of technology.

Railroads are just beginning to explore meaningful investments in technology-driven productivity improvements. Positive train control (PTC) is the rail equivalent of early steps toward autonomous vehicles. Mandated by Congress, PTC has forced the industry to invest in massive communications and wayside infrastructure upgrades that should serve as the platform for greater automation across the railroad network. With investments of about \$11 billion in PTC technology, railroads are also actively looking to leverage this investment in other areas such as improving mobility and telemetry and reducing dark territory. This massive increase in telemetry, automation, and safety technology will only increase the pressure to migrate toward single-person crews; however, union and collective bargaining issues make this a difficult change to implement.

Figure 17
Adoption of PSR improved key operating metrics for Class I railroads¹



¹ PSR is precision scheduled railroading.
² UP average train velocity declined due to work events, weather-related challenges, and network congestion.
Sources: Railroad 10K reports as published on investor relations website; Kearney analysis

As PTC investments taper off, railroads are looking at other technology platforms that could reduce shippers’ longstanding pain points and have meaningful potential to make rail more favorable versus trucking. Automated inspections of track and rolling stock can improve productivity and safety as well as reduce the service and cost impact of disruptions. Predictive maintenance can improve locomotive availability, now often hovering at about 70 to 80 percent, which would reduce the size of the fleet needed and consequently the capital and associated maintenance costs. Although many of these innovations show promise, it’s clear that the next wave of productivity improvements will be more complex to achieve, with no single innovation providing the clear path forward.

In the longer term, railroads will need to do more than embrace technology and improve productivity—rail needs a growth model. Reduced trucking costs, thanks to improved technologies such as alternative energies and platooning, could threaten intermodal volumes. Can railroads rethink their core operations in ways that would impact speed, reliability, visibility, and connectivity to improve the value proposition to shippers, particularly in the short-turn package market?

Could new categories or origin–destination pairings, such as short-haul rail routes, be profitable? How can railroads gain a bigger slice of the expanding e-commerce and package delivery market, where growth will continue to accelerate in the post-COVID-19 world? Can partnerships with other intermodal parties improve rail’s speed and efficiency enough to continue to solidify rail as an essential component of the evolving value chain? Given intermodal’s cost and carbon-footprint benefits, shippers are keen for better prices and reliability. The railroads have noticed, with one rail executive stating, “...I view the highway as a critical competitor for growth, given the market share that trucks represent across North American freight.”

Although these seem like weighty issues, the railroads have recently shown they are able to drive continued profitability despite difficult external conditions. The lessons learned so far have prepared the industry for even bigger challenges ahead.

Water and ports: survival of the fittest

The ocean shipping market has faced continual external disruptions. Anticipation of the 2019 trade wars caused a rush to beat tariffs in late 2018. As a result, shippers entered 2019 with plenty of inventory, thus reducing ocean shipping volumes. The IMO 2020 sulfur regulations became effective on January 1. Now the COVID-19 pandemic has accentuated the downward trend.

In 2019, import volumes declined by 0.6 percent compared to 2018. The volume declines accelerated in Q1 2020, when loaded inbound container volumes dropped by 8 percent. Because shippers signed contracts in the first half of 2019, when momentum from the 2018 trade war remained high, they were unable to take advantage of rates declining in the latter half of the year. Transpacific contract rates for the May 2019–April 2020 period were about 15 to 20 percent higher than the previous year.² Prices in 2020, now including an IMO 2020 surcharge, have increased.

The COVID-19 outbreak has led to many cancelled sailings and significant capacity reduction (see figure 18). Backlogs resulting from Asian production delays could boost volumes in the second half of 2020, but the 2021 and beyond end-market demand is unclear. Because carriers were already struggling with overcapacity, some will fail or be forced to merge.

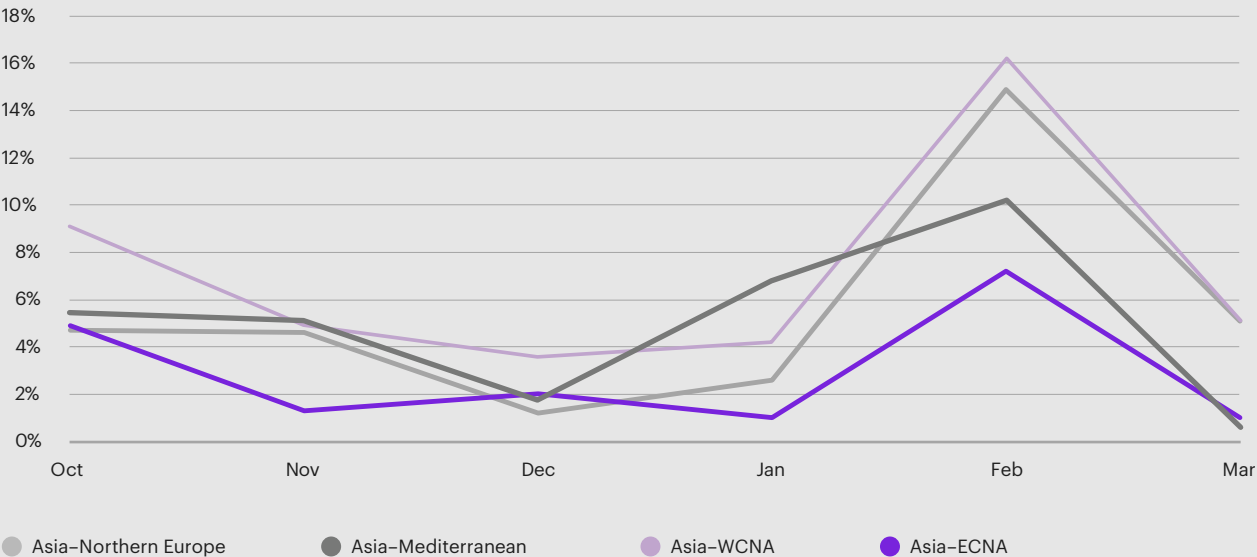
Vanishing cargo leads to blank sailings

With COVID-19 slowing Chinese production, the number of inactive container ships reached record highs in March 2020—a majority waiting to return to Asia. The inactive fleet measured in terms of idle capacity exceeded 10 percent in Q1, reaching double digits for the first time since the Great Recession. To cope with already declining demand accelerated by the coronavirus, carriers are blanking sailings and reinstating “slow steaming,” the practice of sailing ships at lower speeds and taking longer but cheaper routes such as the Cape of Good Hope instead of the Suez Canal.

² The USBLC 3.1 percent cost increase for the water sector also reflects coastal shipping and inland waterway barge traffic.

Figure 18
The COVID-19 pandemic has resulted in missed sailings and capacity reduction

East-West blank sailings as a percentage of operational capacity



Notes: WCNA is West Coast North America. ECNA is East Coast North America.
Sources: Drewry Maritime Research; Kearney analysis

Carriers’ moves to prop up rates and prolong their survival do seem to be working. Drewry’s World Container Index showed positive signs in March and April of 2020 (see figure 19). It’s a bit surprising, given the weakness in 2019 (so weak that it wiped out most of carriers’ 2018 gains) and the declining environment of the pandemic. However, it’s not clear how long carriers can continue mothballing their assets. Major swings in rates could come later in the year—2018 March and April results gave little indication that rates would later shoot up to record levels, nor did 2019 March and April results suggest that rates would later fall.

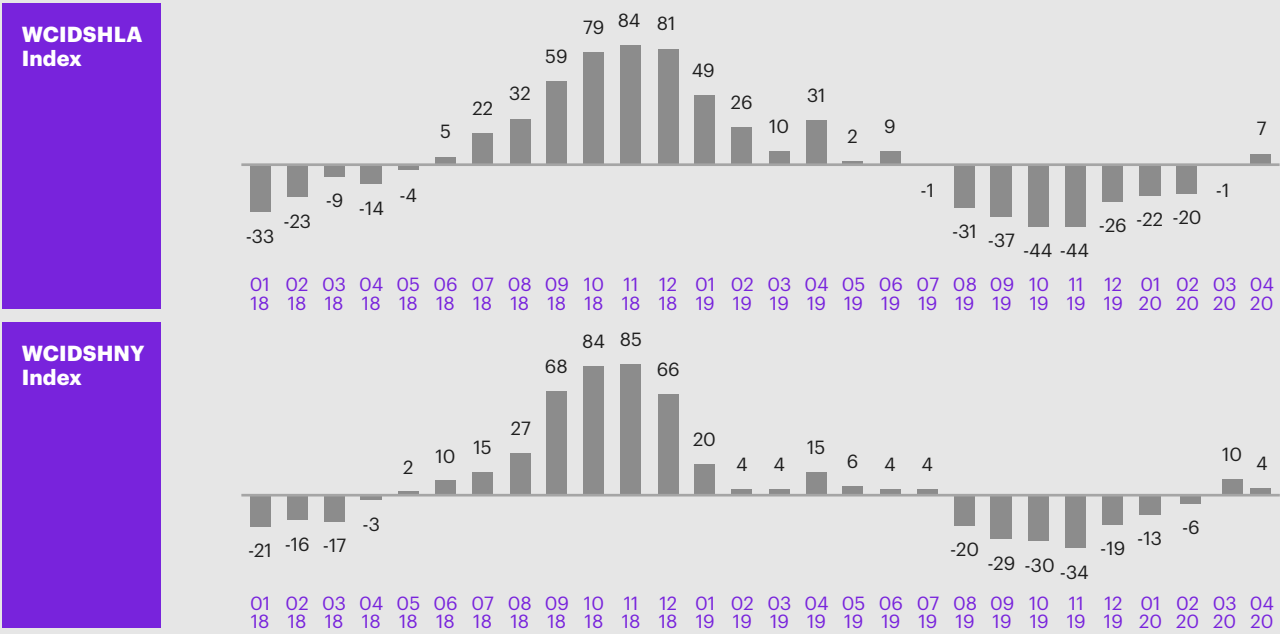
Transpacific ocean contracts are typically signed by May, but this year carriers have generally delayed the deadline due to uncertainties, imposing month-to-month surcharges through the second quarter. Although shippers are always eager to capitalize on carriers’ desperate need for revenue, high April prices made them likely to delay signing contracts.

Whether carriers are successful in maintaining high prices or are sunk by competitors hungry for volume is yet to play out. History suggests a race to the bottom. However, consolidation may have created a new competitive landscape in which carriers will no longer pass along all savings to shippers, according to Lars Jensen, CEO of SeaIntelligence Consulting.

Carriers in trouble

The ocean market has struggled with overcapacity since 2011. Even in 2019, multiple carriers ordered new container ships—so they need to gain market share to support their expansion. This will be difficult as the market contracts and demand shrinks, leading to a zero-sum game among carriers. Even in placid times of opportunity, carriers have a proclivity for price wars, triggered in no small part by shippers’ insatiable appetite for price reductions. In the pandemic and post-pandemic world, price wars could be particularly devastating.

Figure 19
Drewry’s World Container Index showed surprising positive signs in March and April



Note: WCIDSHLA is Shanghai to Los Angeles (Drewry World Container Index); WCIDSHNY is Shanghai to New York (Drewry World Container Index).
Sources: Drewry; Kearney analysis

Carriers may be forced out of business. The Altman Z-score is a financial metric which describes the overall financial health of a company. Companies with scores under 1.8 are considered at financial risk. The majority of ocean carriers are under that threshold (see figure 20). Furthermore, most carriers were performing poorly even during 2018’s relatively good times. These troubling trends will only accelerate with COVID-19 effects.

Shippers reeling from the pandemic and eager to cut costs might serve as an accelerant in this deadly race. But they might be wise to step back and complete a comprehensive financial assessment, as such actions could contribute to carrier bankruptcy and potentially result in structural damage to the ocean shipping industry.

Historically, many ocean carriers have been backed by national sponsorships. During the 2008–2009 global recession, no midsize or larger carriers went under, although they survived in part by consolidating. However, if carriers seek additional subsidies due to the impact of COVID-19, they may find governments inattentive—the crisis creates so many diverse shocks that governments may end up focusing their attention on other economic stimulation efforts. Carriers with historic track records of government support are in a better position to receive future aid.

Dim horizons for bulk and crude

Growth for dry bulk trade was weak in 2019 due to disruptions in iron ore and coal, which combine to constitute more than half of total bulk trade. A Brazilian dam disaster and subsequent rains in the first half of 2019 brought the Brazil–China iron ore trade down by 12.9 percent compared to 2018, while Australian wildfires plagued coal operations in the latter half of the year.

Figure 20
The majority of ocean carriers are considered at financial risk according to their Altman Z-score¹

Scores under 1.8 indicate financial risk

Carrier	AP Moeller-Maersk	CMA CGM	OOIL	Evergreen Marine Corp	Yang Ming	China Cosco	Zim
2018	2.48	1.81	2.28	1.1	0.71	0.6	-0.07
2019	2.14	1.26	1.99	0.92	0.59	0.91	0.21

¹ Ranked by TEU capacity
Sources: Drewry Altman Z-score; Kearney analysis

In 2020, demand fell as COVID-19 halted production in the Chinese industrial sector. Capesize vessels (large ships primarily used for iron ore and coal) wrapped up Q1 with the second-worst performance ever, following Q1 2016, and the Baltic Dry Index decreased to around 450 points in January 2020, reaching the lowest level since 2016. Rates for capesize vessels in February hovered around \$2,500 to \$4,000 per day; the breakeven is around \$13,000 per day. In addition, fleet growth exceeded demand growth in both 2019 and 2020, causing excess capacity and looming liability risk. The only glimmer of hope in the bulk sector is the soya trade, which has seen a sharp volume increase after tariffs were lifted. Despite COVID-19, the USDA expects trade to increase 2 percent by September. However, the increase in soya trade is insufficient to offset other losses; dry bulk trade is expected to grow by less than 1 percent in 2020.

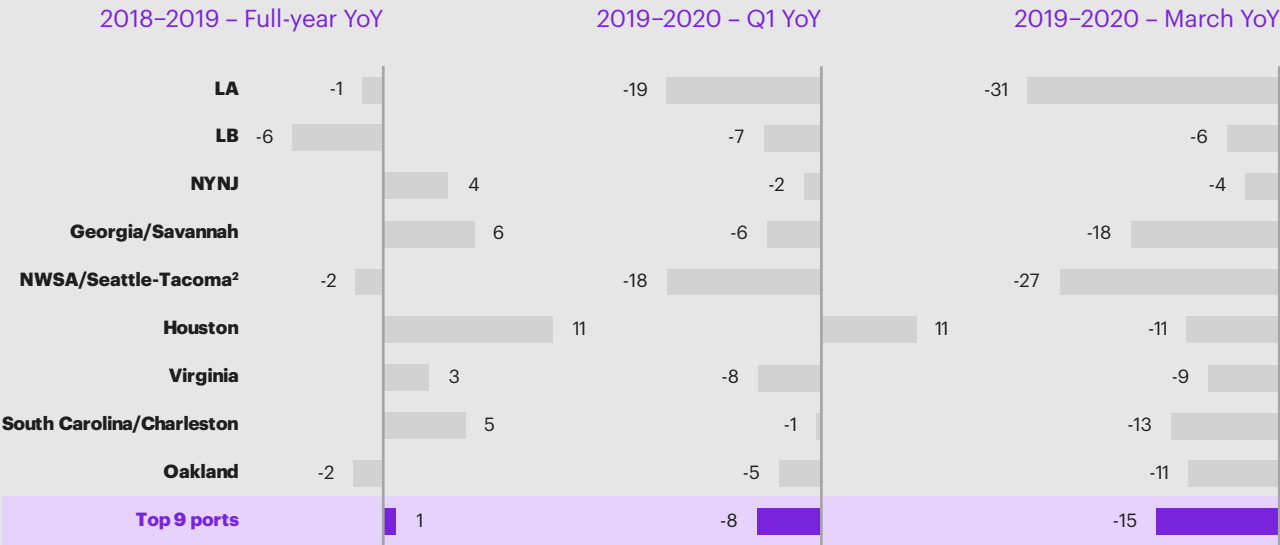
When the price of crude oil dropped below zero in April, it suggested a crumbling of demand for crude and tightness in storage capacity. About 10 percent of global large crude tankers have been able to charge for “floating storage.” Other tankers will surely take advantage of this opportunity, although it may not be enough to make up for losses.

Ports: a tale of two coasts

Although volumes had been steadily rising in the high single digits since Hanjin’s bankruptcy in 2016, total container throughput at the top nine ports in the US rose by a paltry 0.8 percent in 2019. However, the dismal growth is not that surprising, given that 2018 was a record-setting year with an armada of containers triggered by the trade war.

While 2019 throughput declined at major West Coast ports, which handle the majority of US traffic, throughput increased at East Coast ports. Volumes are migrating to the East Coast thanks to the widening of the Panama Canal, the raising of the Bayonne Bridge between New York and New Jersey, and recent and coming upgrades to port infrastructure making the East Coast more attractive. Additionally, West Coast ports have become relatively unattractive with congestion and strikes (see figure 21).

Figure 21
Container volumes are shifting to the East Coast
(% change in total TEUs handled¹)



¹TEU is twenty-foot equivalent.
²Excluding domestic traffic
Notes: YoY is year-over-year. LA is Los Angeles, LB is Long Beach, NYNJ is New York/New Jersey.
Sources: Individual port statistics, Kearney analysis

Although ports started 2020 with optimism about growing volumes and newfound digital efficiencies, COVID-19 has them now wrangling with declining volumes and other issues. Many ports are experiencing congestion, with hundreds of thousands of boxes stranded at terminals as shippers are unable to pick up shipments and staffing conditions have been altered. Throughput at the nations’ top ports declined 8 percent in Q1 2020, 15 percent in March alone.

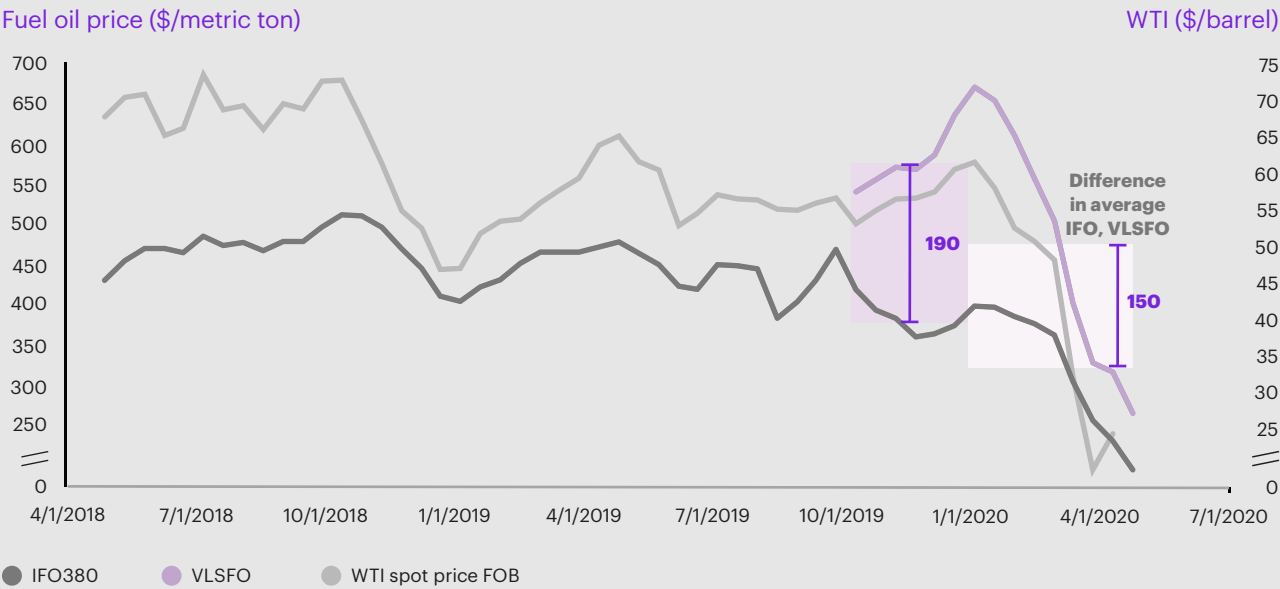
With five locations fully or partially automated, US ports are catching up to European and Asian ports. The COVID-19 pandemic has spurred additional interest in automated cranes, automated guided vehicles, automated port railway operations, and automated barge operations between nearby container ports. Pier 400 in Los Angeles, North America’s largest terminal, run by Maersk subsidiary APM Terminals, aims to increase competitiveness, reduce labor costs, and reach zero emissions by 2030 through its use of automated container handling equipment. Although the International Longshore and Warehouse Union opposed this automation due to concerns about jobs, it settled in mid-2019, and dockworkers will receive training to learn how to use and maintain automated equipment.

Scrubbers or no?

Going into 2020, the biggest issue in the ocean market was how carriers would address the IMO 2020 sulfur regulations. Through 2019, carriers seemed slow to announce their preference between two options—switch from marine fuel oil to low-sulfur fuel oil or install scrubbers. According to HSBC, as of March 2020, 19 percent of the global shipping fleet (in terms of gross tonnage) and more than one-third of the 1,650 new builds (in gross tonnage) will be fitted with scrubbers.

The 80 percent without scrubbers may have made a good bet. Payback for the scrubber investment is measured by the spread between low-sulfur (VLSFO) and high-sulfur (IFO380) fuel. In early 2020, the spread narrowed more than expected, due to a combination of the Russia–Saudi price war and refinery efficiencies (see figure 22). That expanded the payback period, making scrubber investments increasingly unattractive to struggling carriers. By March, some carriers were even cancelling planned scrubber installations. Then as the COVID-19 collapse in demand reduced all oil prices, the spread narrowed further.

Figure 22
The spread between low-sulfur and high-sulfur fuel costs narrowed more than expected in early 2020



Notes: WTI is West Texas Intermediate. IFO is intermediate fuel oil. VLSFO is very low-sulfur fuel oil. FOB is free on board. The difference in average IFO, VLSFO is the difference in average for 2019 and average for 2020.

Sources: Oilprice.com, Ship & Bunker, US Energy Information Administration; Kearney analysis

Carriers are passing on to shippers their increased costs in meeting the regulations. The bunker adjustment factor (BAF), a carrier surcharge related to oil prices, is expected to be a key point in 2020 contract negotiations.

Navigating muddied waters

To achieve long-term stability, ocean carriers will need to find ways to make their supply chains more agile and reduce costs. COVID-19 will pressure the sea freight industry—infamous for being slow to digitize—to pay closer attention to innovative cost-cutting measures. Shippers want visibility; carriers need to streamline processes such as tendering loads and tracking shipments.

Many of the top liners already have start-up incubator programs, and these liners are at an advantage to use these programs to drive creative solutions. Liners need to keep a pulse on the market for other innovative players. For example, ioCurrents analyzes on-board data to predict anomalous behavior, Nautilus Labs uses predictive analytics to reduce fuel consumption, and Maindeck manages the ship maintenance and inspection process.

The COVID-19 crisis focuses attention on shorter-term issues. Despite 2019's various negative impacts on ocean freight, carriers found ways to perform surprisingly well—but likely not well enough to weather 2020's impacts, which will be far greater. SeaIntelligence estimates that the pandemic will collectively cost carriers \$23.4 billion in 2020.

Shippers, meanwhile, need to plan. For years they have benefited from low prices due to the industry's oddly stable overcapacity. Ironically, the empty ships of 2020 will likely increase costs through the rest of the year because the issues have come to a boiling point. Carriers will either cover their costs or go out of business. Therefore, maintaining communication, receiving frequent updates, and tracking carriers' financial performance will be crucial for shippers moving forward. Shippers need to be prepared to react to certain market outcomes as a result of COVID-19, such as consolidation and bankruptcy, and be ready to diversify their carrier portfolio. Ultimately, shippers need to anticipate those increased costs, prepare to negotiate, and keep options available to quickly pivot if needed.

Air freight: uncertainty reigns

No logistics sector is more affected by the COVID-19 pandemic than air freight. The Centre for Aviation (CAPA) predicted in March 2020 that most world airlines would be bankrupt in two months, although governments worldwide later jumped in to subsidize airlines with various stimulus packages.

About 48 percent of air cargo is carried by passenger planes—and that capacity has been decimated by COVID-19. In March, American Airlines cancelled 55,000 flights and parked 450 planes, Delta grounded 600 aircraft, Lufthansa cancelled 23,000 flights (90 percent of its routes), and Emirates closed all of its passenger routes. US passenger airline stock prices dropped an average of 55 percent from when the first COVID-19 cases outside of China appeared in late January to late March. Multiple airlines, including Avianca and LATAM, have already collapsed.

Pure cargo freighters, exempt from travel bans, have been less impacted, and have even gained. For example, in early June, Atlas Air's share price was up almost 3x from its March 12 low, and 1.65x for the year as a whole.

Meanwhile, demand is also unstable. Industrywide air cargo tonne kilometres (CTKs) fell precipitously in April, by 28 percent—the largest-ever monthly decline, according to the International Air Transport Association (IATA). In its early stages, COVID-19 shut down Chinese factories, disrupting global supply chains. For example, with no auto parts coming out of Wuhan in January, even pure-cargo carriers faced empty flights due to the limited Chinese production.

In those early stages, one concern was that later in 2020, rebounding demand from restarting factories would outstrip available air cargo capacity. But now that demand is slowing from factories and consumers around the globe, the uncertainty is only increased. US retail store closures are causing incremental second-half order reductions of about 10 to 20 percent.

From January lows, cargo utilization grew quite high mid-pandemic. One large air freighter mentioned in late March that utilization was at peak-season levels. As of late May, air freight rates out of Shanghai were as much as three times higher than the previous year, although rates have started to moderate after two months of rapid increases.

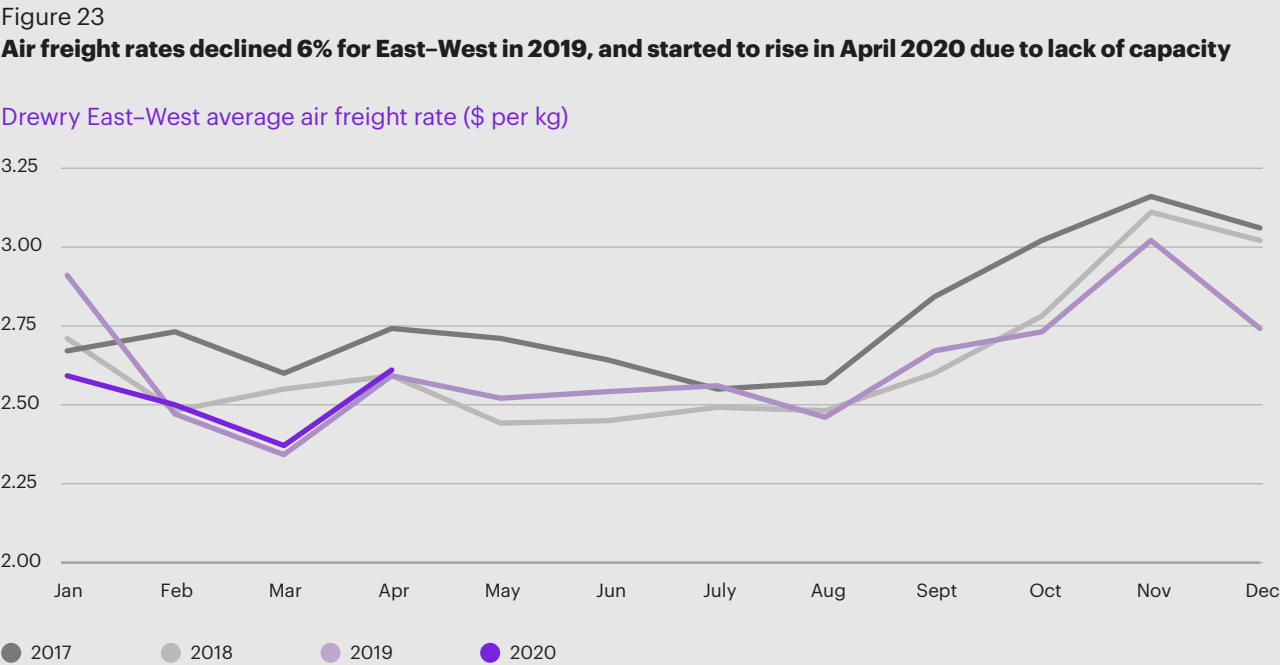
A troubling background

Air freight demand had already been declining, with 2019 the worst year since the 2009 global financial crisis. Total CTKs declined by 3.3 percent from 2018 levels, while available CTKs increased by 2.1 percent. A major source of weakness was the auto industry, as major carmakers slashed production targets due to slowing demand. April 2020 marked 13 months of year-on-year declines in cargo volumes.

The year was also marked by unresolved trade frictions, including the US–China trade war contributing to a slowing Chinese economy (with economic growth at a 30-year low), the US putting tariffs on European aircraft and agricultural products, and Brexit posing potential economic and political impact.

On the other hand, industry bright spots included growth in the healthcare and e-commerce industries, and continued expansion of the global middle class. Overall 2019 East–West rates declined 6 percent from 2018 (see figure 23). April 2020 marked 13 months of year-on-year declines in cargo volumes.

April 2020 marked 13 months of year-on-year declines in air freight cargo volumes.



Note: Weighted average of all-in air freight buy rates paid by forwarders to airlines for standard deferred airport-to-airport air freight services on major East–West routes. Rates are expressed in \$ per kg and include three components: the base rate, the fuel surcharge, and the security surcharge.
Sources: Drewry; Kearney analysis

Future innovations

In the very long term, electric aircraft could transform the air cargo market. A hybrid aviation market is expected to develop starting in 2028, growing to \$178 billion by 2040, according to UBS. The market, which includes players such as MagniX and Eviation, would meet public pressure to reduce harmful emissions.

Similar transformations could come from drones—heavy-lift cargo planes, the airborne equivalent of autonomous trucks. Unlike last-mile drones with typical payloads under 20 pounds, these air cargo drones under testing can carry more than 250 pounds of cargo. The nonmilitary unmanned aerial vehicle (UAV) market is booming. Valued at \$5.5 billion in 2019, the market is expected to grow at 11 percent per year. Companies working on cargo UAVs include Elroy Air, Boeing, and Pablo Air.

Less glamorously, the industry makes slow but steady progress in digitization and related fields:

- Penetration of electronic air waybills (eAWBs) increased from 59 percent to 68 percent in 2019, according to IATA.
- Although cargo management systems remain highly fragmented, two examples show promise. Germany-based cargo.one allows freight forwarders to book capacity on the flights of its seven member carriers. And the H5 solution from UK-based Hermes Logistics Technologies is a cloud-based application to improve the operations of airports, airlines, and ground handlers.
- The Seattle-Tacoma International Airport is using artificial intelligence (AI) and computer vision (CV) to detect and catalog objects in its air cargo area. Its 2019 PlaneInsight pilot project, designed to increase efficiency and accountability, also identified several future opportunities to use machine learning (ML) in cargo operations.

Carriers must increase flexibility

But will today's air carriers survive long enough to explore those future technologies? Certainly for passenger airlines, government bailouts, mergers, or other massive industry restructurings seem likely. For US cargo air carriers, the CARES Act provided up to \$4 billion in aid to continue paying employees.

In general, the COVID-19 pandemic reminded shippers of the need for supply chain resiliency and agility. Because shippers often find air cargo the most agile transportation mode, it will remain an essential option in many supply chains.

However, as carriers address immediate financial concerns, they also need to study the structure of their operations. The COVID-19 downturn and eventual recovery highlight the need for carriers to immediately find ways to flex both capacity and variable costs.

For example, when passenger-airline underbelly capacity evaporated, FedEx was able to adjust with heavier reliance on its own purple-tailed aircraft. As stay-at-home orders boosted demand for small parcel deliveries, FedEx repurposed cargo capacity to quickly deliver essential goods. Similarly, other cargo freighters shifted from electronics to medical supplies—a change that sometimes required creating new routes or adapting to special required temperatures.

Passenger carriers such as American Airlines, Delta, and United then also pivoted to turn their idle passenger planes into pure cargo planes for high-volume cargo routes. Depending on the length of the pandemic and the shape of the recovery, carriers may need to start planning for a longer shift away from passenger demand.

Genuine flexibility goes deeper than these temporary shifts and gets complicated quickly. Cargo has always been dynamic, especially in comparison to passenger transport. With the pandemic creating demand uncertainty, and with potential recovery of passenger airline operations creating capacity uncertainty, the coming year will be even more dynamic than usual. To reassess their ability to react to the recovery—much less a future disruptive global event—carriers will need to think about risk, [ideally creating a comprehensive enterprise risk management \(ERM\) framework](#).

Shippers must embrace dynamic supply chain

The profound uncertainty in air cargo markets highlights a key finding of this report as a whole: shippers are seeing that rigid supply chains are vulnerable to disruptions. By [making your supply chain more dynamic](#), you can better sustain operations in the face of varied major global events.

The next disruption may be an air cargo capacity shortage resulting from COVID-19 recovery, a shortage resulting from carrier bankruptcy, an overcapacity resulting from new viral outbreaks, or (most likely) something we can't predict today. What shippers can do today is prepare for those events by planning for multi-carrier and multi-modal logistics. Can you switch if need be from passenger belly transport to pure freighters? If so, will the cargo arrive at different ports, requiring domestic truck transport? Now is the time to plan that out.

Having the capability to react to disruptive events hasn't been rewarded in the past, when the focus was always on reducing costs. But recent events have showed shippers that planning for disruption is a new muscle they need. By investing in enterprise risk management models, developing relationships with trusted partners, and implementing measures to flex capacity and variable costs, you develop the people, processes, and infrastructure to dynamically adjust to the next sudden change, regardless of its direction. In international supply chain management, you should build resiliency into your supply chain model by ensuring a good mix of cargo and passenger capacity in your network, as well as having a robust air-ver-sus-ocean selection process in place.

Warehousing: stability in growth

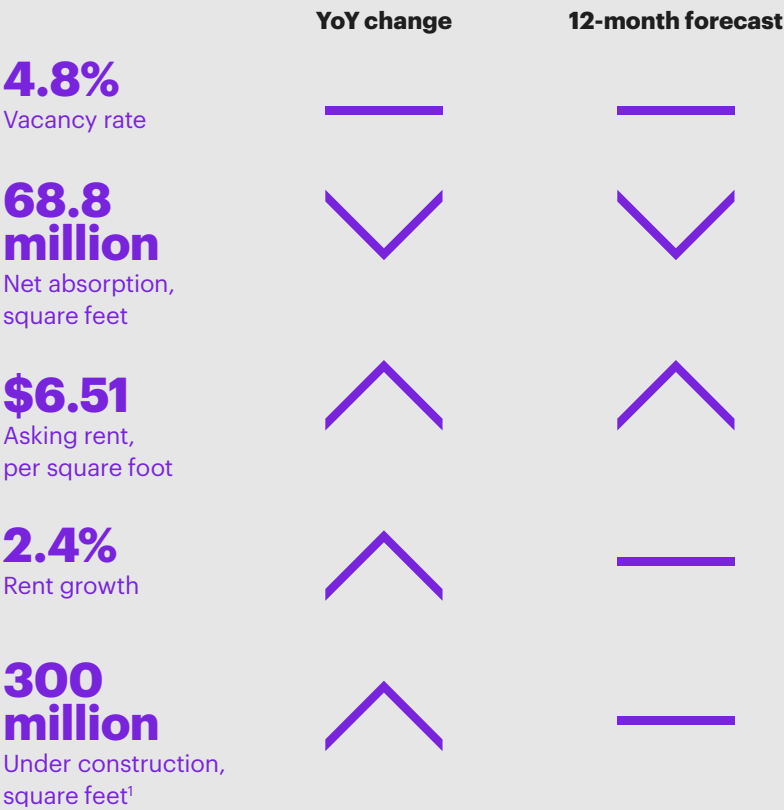
The 2019 warehousing market was stable. Rents continued to rise, and vacancy rates remained fixed near historic lows. New supply was built, and quickly snapped up. E-commerce continued to drive growth, especially in smaller, high-amenity urban warehouses. Q1 suggested more of the same in 2020, but sudden changes due to the COVID-19 pandemic, such as the e-commerce boost, gave shippers pause for a re-think.

Industry fundamentals continued to perform well in 2019, in line with historical trends (see figure 24 on page 37). After a slow start, demand finished 2019 strong, with 233.8 million square feet of net absorption. New supply grew even faster, with construction of 300 million square feet, 7 percent higher than 2018 (see figure 25 on page 38). But with an increase in leasing activity, vacancy rates remained unchanged at 4.8 percent (see figure 26 on page 38).³

The construction pipeline remains full. The fourth quarter of 2019 saw delivery of 100 million square feet of supply, the highest square footage completed in a single quarter on record. Tenants—primarily traditional and online retailers as well as third-party logistics providers—prefer newer space, especially with amenities such as taller clear heights and greater energy efficiency. The higher ceilings place emphasis on increased automation, which is best exploited at 48-foot heights as opposed to the classic 35-foot heights. But with vacancy rates so low, tenants often lease any space they can find.

³ Net absorption measures physical occupancy, whereas vacancy rate measures leasing activity. The fact that 2019 net absorption was less than construction completions, even as the vacancy rate remained unchanged, reflects considerable pre-leasing of space not yet physically occupied—another indication of high demand.

Figure 24
Warehousing industry fundamentals performed well in 2019



¹Represents only warehouse/distribution product
Note: YoY is year-over-year.
Sources: Cushman & Wakefield; Kearney analysis

Positive prospects post-COVID-19

While the near-term situation is mixed, there are signals that the market may remain somewhat stable through the COVID-19 crisis and emerge on solid footing.

From a fundamentals perspective, the market was well positioned to absorb a short-term disruption. The vacancy rate was at an all-time low and supply was relatively constrained.

On the demand side, many users are on hold, a number of large logistics and retail users are expanding, and very few businesses are downsizing or vacating. Negative user demand should have negligible overall impact on vacancy—and, perhaps, rents.

As a result, near-term projections indicate only a small increase in availability over the pre-pandemic forecast for 2020. Longer-term projections point to growth in three areas—e-commerce, inventory on hand, and reshoring—that will significantly support demand for warehouse space across the country.

Growth in e-commerce sales will raise demand for logistics space in all sizes. While e-commerce has been growing at a steady rate, the main obstacles to even greater growth have been 1) an objection by some consumers to online commerce and 2) slow acceptance of e-commerce in certain product segments, such as groceries. But, given shelter-in-place measures due to COVID-19, e-commerce adoption has spiked and is expected to stay high.

If e-commerce grows at an annual 20 percent rate over the next five years (instead of the projected 14 percent), a need for up to an additional 400 million square feet is forecasted.

Figure 25
Demand finished strong in 2019, but supply grew even faster

Space demand and deliveries
 (million square feet)

- Net absorption
- Under construction

¹Represents only warehouse and distribution product
 Sources: Cushman & Wakefield; Kearney analysis

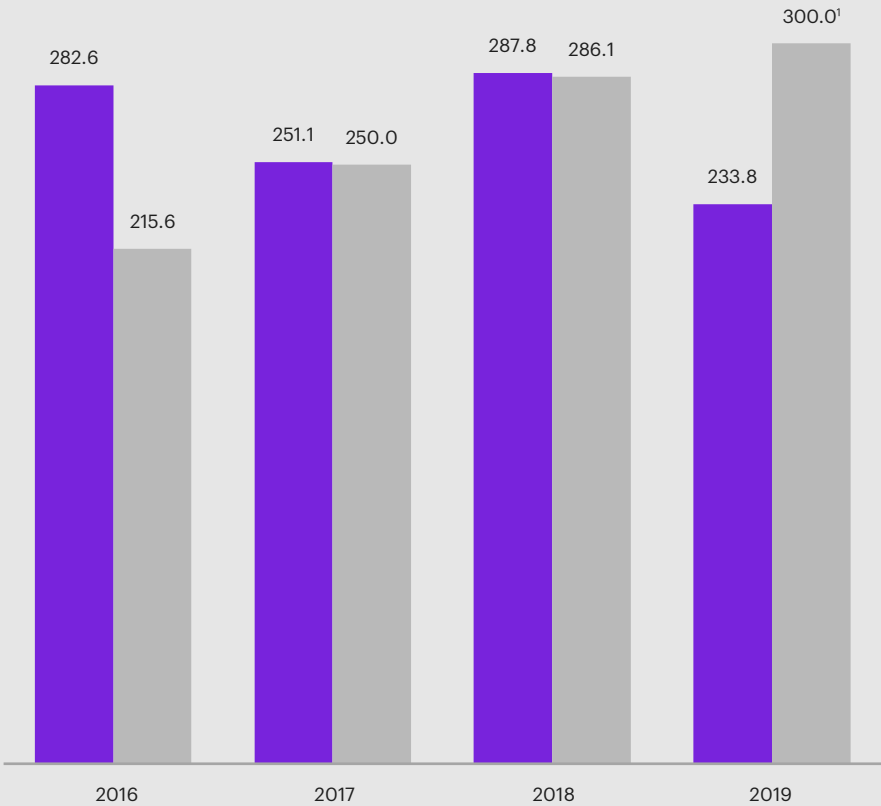


Figure 26
Vacancy rates remained unchanged in 2019

Overall vacancy and asking rent



Sources: Cushman & Wakefield; Kearney analysis

Change in inventory policies around reserves—safety stock—will increase the demand for warehouse space. Many supply chains were designed to hold minimum inventory in pursuit of a just-in-time model. The COVID-19 crisis exposed the weakness in this strategy when a production source shuts down. Going forward, companies will increase reserves of inventory. This safety stock will necessarily sit in somebody's warehouse. Forecasts from CBRE Research indicate that a 5 percent increase in business inventories would require an additional 700 million to 1 billion of occupied square feet.

Finally, and this is a trend that will develop over a much longer term, the trend of **near-shoring and reshoring manufacturing to North America will accelerate.** A need for risk mitigation will encourage manufacturers to diversify their points of production out of Asia and closer to home. While this would reduce inventory needs for finished goods, those reductions would be more than offset by increased requirements need for raw material storage.

In each of the top three construction markets, more than 80 percent of the space under construction is speculative in nature.

Trends: speculation, labor, and forward deployment

Speculative construction. The amount of warehouse and distribution space under construction (300 million square feet) is noteworthy and even more so is how much of it is speculative. In each of the top three construction markets, more than 80 percent of the space under construction is speculative in nature (see figure 27 on page 40). Approximately 40 percent of that speculative construction is pre-leased. The remainder of the available pipeline is enough to provide occupiers with additional options for growth, but not sufficient to drastically shift the vacancy rate, derail rent growth, or undermine asset values.

Pre-COVID-19, this mix reflected the market's great confidence in industrial development. That is no longer the case for speculative construction. According to CBRE, speculative construction projects are now on hold, to a large degree, and will, in turn, result in less first-generation space entering the market in 2021.

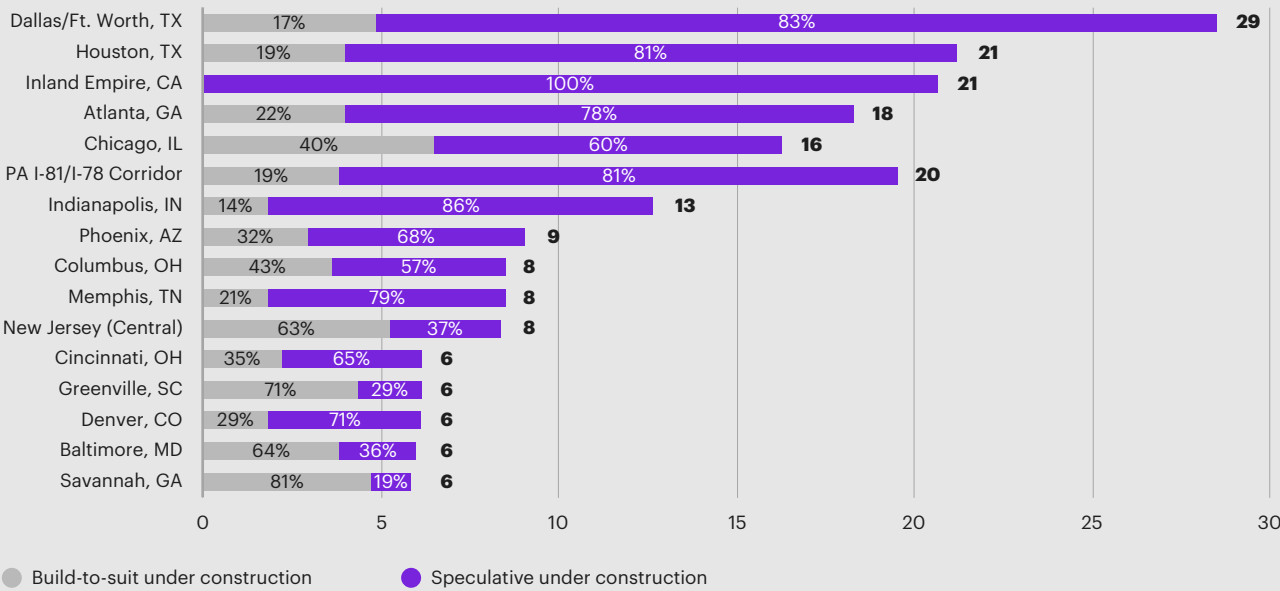
Limits from labor. In addition to physical space, warehousing supply is limited by tight labor markets. As warehouses become more technologically sophisticated, they need increasingly skilled labor. Yet seasonal fluctuations in warehousing activity means that some labor demand is temporary.

Although the average hourly wage for logistics employees is higher than the national average, it is lower than that of comparable industries, leading to shortages. Many businesses are implementing innovative ideas to attract, retain, and motivate employees. But unless COVID-19 leads to long-term high unemployment rates (a dismal outcome because it implies a recession that would hurt all businesses), the labor challenge will remain.

To address labor shortages and retain skilled labor in this tight labor market, operators must develop innovative ideas in addition to competitive salaries, benefits, and culture strengthening. This is especially crucial for businesses that are not highly automated, as they require more labor to operate. Operators are tapping into pools of employees with complementary schedules and skills, such as firefighters, bus drivers, and military personnel. Other strategies include offering "stay-on" bonuses to reduce attrition during peak season.

Figure 27
Much of the warehouse and distribution space under construction is speculative

Speculative vs. build-to-suit construction (million square feet)



Sources: Cushman & Wakefield; Kearney analysis

Post COVID-19 forward-deployment acceleration.

The consumer shift from in-person to online shopping is seeing unprecedented acceleration due to COVID-19 lockdowns. This is further driving a potential shift to more regional supply chains in the future. Retailers are using forward deployment of inventory to enable a localized distribution strategy that offers flexibility and proximity to urban centers. As a result, rents for close-to-consumer warehouses under 120,000 square feet have increased by 30 percent in the past five years. As an alternative, retailers with an existing physical footprint are converting their back rooms into mini-warehouses, or micro fulfillment centers. For example, by the end of 2019, Target fulfilled 80 percent of its online orders through stores.

Some retailers—Walmart, Albertsons, Stop & Shop, Meijer, and Hy-Vee, among others—are increasingly using dark stores. These are closed-to-the-public supermarkets (indeed, they’re often shuttered stores) used for forward-deployed inventory.

Another expansion of the idea is shared-use networks, where multiple companies serve mutual customers with the same distribution assets. Although they typically collaborate across many transportation and operational functions, one major motivation is to save money on shared warehouse space for forward-deployed inventory.

The COVID-19 crisis highlighted key gaps in supply chain resiliency for most companies. Warehousing operations and strategies were the first to get impacted. For example, as consumer demand shifted to bulky items such as toilet paper and bottled water, warehouses needed to reallocate space. As all warehouses struggled with limited inventory and throughput capacity, some failed to meet their on-time in-full commitments.

But many warehouses overcame pandemic-related challenges. Successful tactics included:

- **Labor balancing:** staggered shifts with skeletal crews, enhanced scheduling, and limiting the work floor to essential labor
- **Partnerships:** loaning warehouse labor between discretionary and staple companies, under strict guidelines
- **De-bottlenecking:** to counter surges, making upward adjustments of safety stock (both raw material and finished goods), increasing delivery frequency, changing sourcing locations, and expanding ground shipping out of traditional warehouses

Automation is coming

Mobile robots can fulfill orders more quickly and reliably than humans. And if the virus that causes COVID-19 proves long-lived on various surfaces, mobile robots could be outfitted for disinfection and deep cleaning. Thus, in warehousing sectors that became more hectic during the pandemic, such as retail and healthcare, interest in warehouse automation has grown even higher. Conversely, warehouses serving sectors depressed by the pandemic, such as chemicals and luxury goods, will lack the cash to invest in automation.

Automation spending totaled \$14 billion in 2019, and was expected to almost double by 2025, according to LogisticsIQ. Demand for automation is fueled by evolving customer expectations, service promise, labor productivity, and labor pool availability. Warehouses are also attracted to new lease-like business models such as Robotics as a Service (RaaS) and pay-per-pick.

The market for autonomous mobile robots (AMRs) is growing especially quickly. Providers such as Locus Robotics deployed thousands of robots in retail and 3PL warehouses worldwide, consistently achieving 2x to 3x productivity gains with a payback period of four-plus years. A likely future growth area for AMRs is e-commerce returns, which currently pose a big headache for retailers.

Household grocery fulfillment has proven comparatively difficult to automate, due to temperature requirements and the eaches picking process, which differs from traditional pallet-based processes. However, with online grocery sales growing 15 percent per year even before the pandemic, developments include:

- Ocado announced the first fully automated grocery warehouse in 2019—a technology it's now deploying to Kroger and other retailers.
- Some grocery retailers are building hyperlocal micro fulfillment centers (MFCs) to streamline online order processing. An MFC is mostly a goods-to-person system that stockpiles groceries in compact, vertical rows, using AMRs known as open shuttles rolling independently within the MFC to assemble the orders—picking, for example, 60 to 70 items in just minutes. An MFC usually takes 12 weeks to deploy at a cost of \$3 to \$4 million. Grocers such as Big Y, Sedano's, Albertsons, and Ahold Delhaize USA are investing in them with partners including Takeoff, Fetch Robotics, 6 River Systems (recently acquired by Shopify), and others.

Media attention focuses on using drones to deliver from a warehouse to a consumer. However, drones inside of warehouses are closer to transforming the logistics industry. With 5G-enabled indoor positioning systems including light detection and ranging (LIDAR) and Bluetooth low energy (BLE), drones will help warehouses take inventory frequently, safely, and accurately. With high initial implementation costs, they're likely to first be deployed in large, high-turn-over warehouses.

Other familiar warehouse technologies include automated storage and retrieval systems (AS/RSs) and order-picking technologies. Although both will continue to mature, innovations will be limited by speed to deployment. These systems traditionally have a deployment window of 12 to 18 months, which isn't attractive in the fast-changing warehouse environment.

To manage these complex and diverse automation systems, warehouses need a warehouse execution system (WES). A WES can offer real-time visibility to throughput and bottlenecks, direct management of picking subsystems, and run simulations to plan and allocate resources, among other capabilities. Although some people hope that the WES can replace the traditional warehouse management system (WMS), a WMS still performs many essential functions, and it may take three to five years for a WES to become mature enough to replicate them.

The current robotics and automation market is bifurcated. Large OEMs and integrators boast established systems, technologies, software, and automation systems. Small start-ups are focused on specific use cases such as inventory counting and control. In coming merger activities, big players will likely absorb start-ups to augment their capabilities as stand-alone solutions.

Conclusion

In sum, warehouses' responses to the initial wave of the COVID-19 crisis involved a full-strength effort to maintain business continuity—mostly successfully. That success could lead to increased consumer trust in e-commerce, generating even greater demand. If so, the future would bring more frenzied growth for warehouses. Then again, for years the sector has adapted and thrived amid such frenzied growth.

In warehousing sectors that became more hectic during the pandemic, interest in warehouse automation has grown even higher.

Freight forwarding: the value of experience

Despite the US market contracting by 1.7 percent and other ripple effects from the trade war with China, many freight forwarders were able to grow their revenues and profits in 2019 (see figure 28).

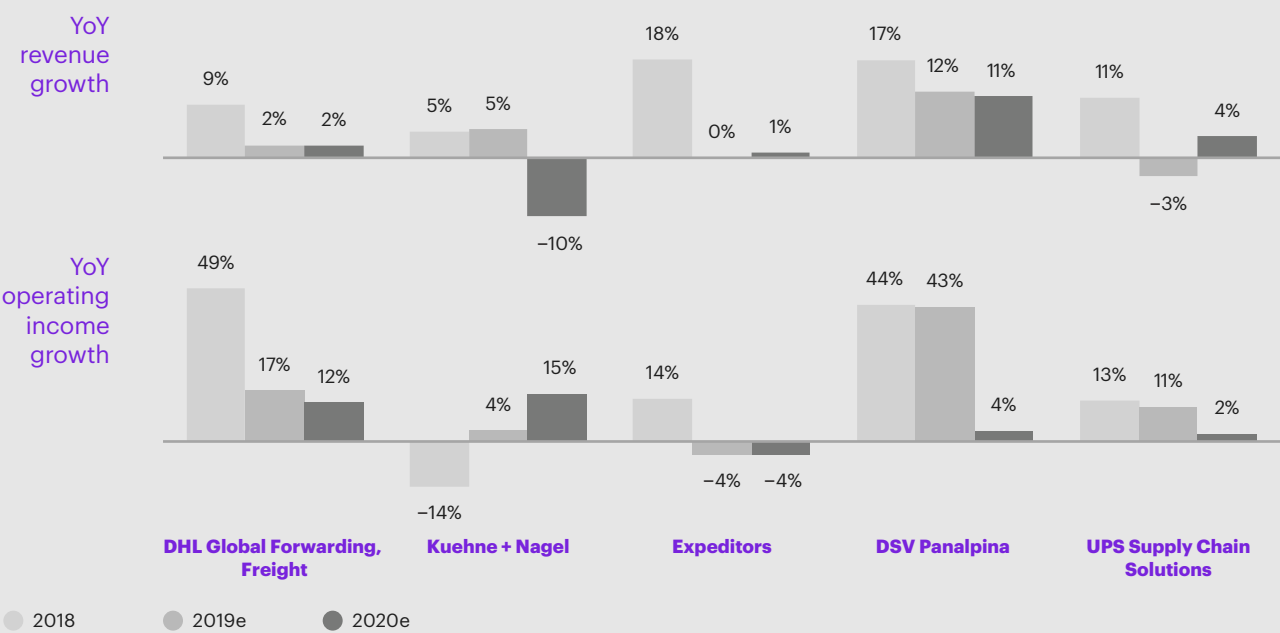
Forwarders navigated challenging conditions with stronger capacity management and continuous margin improvements, while being supported by lower fuel prices as well as inventory buildups. Companies such as DHL and Kuehne + Nagel delivered strong growth by establishing a footprint in the emerging manufacturing hubs of Southeast Asia and Eastern Europe. By contrast, carriers that experienced less growth, such as Expeditors and UPS, were more reliant on North America. In addition, many forwarders focused on more compelling services to navigate 2019's challenges, transforming their businesses through superior application of technological innovation to compete with tech-driven challengers.

Overall, freight forwarders continued to warrant the faith of shippers that are seeking strategic partners to help them navigate ever-evolving market complexities. But if they are going to continue to meet expectations, they must inevitably tackle digital transformation.

Digital forwarding: challenges and success strategies

Technology is changing the very nature of the freight forwarding landscape. Challengers, such as Flexport and FreightHub, and e-commerce giants with strong in-house logistics capabilities, such as Amazon and Alibaba, are all seeking to capitalize on increasing mobile computing power, wider availability of cloud infrastructure, faster communication, and federated logistics applications. These players have the advantage of agile, new IT infrastructure that can provide quick, flexible access to shipment information.

Figure 28
Freight forwarding growth momentum has slowed, but is still expected to be positive in 2020



Note: YoY is year-over-year.
Sources: Factiva, JP Morgan, SIG, Sinotrans annual reports, DB annual report; Kearney analysis

Amazon is changing the rules of the logistics game, as it is predicted to reach a volume of 6.5 billion packages per year by 2022, which would outpace both UPS and FedEx, predicted at 5 billion and 3.4 billion, respectively. Though hardly giants, upstarts such as Flexport and FreightHub are also worthy of attention. In 2018, Flexport nearly doubled its revenue from 2017 to \$440 million. In February 2019, Flexport secured a \$1 billion investment by the SoftBank Vision Fund, which valued the company at \$3.2 billion. Flexport recently even announced an expansion of its service portfolio to include a data-driven trade advisory service.

While challengers have developed strong digital platforms, they have not yet garnered much market share (Flexport’s estimated market share was 0.3 percent at EOY 2019), mainly due to lack of infrastructure and relationships. Meanwhile, incumbents have the infrastructure, expertise, information, and relationships, but lack the digital capabilities. Many depend on legacy IT systems that originated in accounting or enterprise resource planning (ERP) functions and are ill-suited to be collaborative integration platforms for logistics applications.

Many forwarders were able to grow their revenues and profits in 2019 and 2020 is expected to be incrementally better than previous years.

Incumbents are increasingly adopting new technology, and many are, in the words of Damco COO Martin Ring, “embracing the new technologies as they become available.” Examples of these steps include:

- Damco’s parent company Maersk has been building digital forwarding capabilities through internal developments (Twill for pricing transparency, TradeLens for enabling paperless transactions in ocean freight), external partnerships (Stargo for route and price optimization driven by machine learning), and investments (FreightHub for digital freight forwarding).
- Kuehne + Nagel has successfully developed FreightNet to generate real-time air and less-than-container load (LCL) quotes, including a state-of-the-art API integration with Air France. Kuehne + Nagel also used big data and predictive analytics in Sea Explorer for supporting freight planning across 1,200 ports; established a web-based control center through myKN; and brought these all together in a single platform, eTouch, for a seamless customer experience.
- UPS upgraded its Flex Global View, a platform that provides shipment and purchase order-level tracking with visibility across modes. New features include a new supply chain dashboard view that makes it easier to quickly access supply chain data, reporting that uses the latest data visualization tools, and support of Spanish, French, and Mandarin Chinese.
- DB Schenker recently rolled out its digital platform Connect 4.0, which includes features such as instant quoting for full container load (FCL) and LCL shipments, choice of sailing dates, and live chat support.
- DHL, finally recovering from its \$380 million SAP upgrade in 2015, has centered its 2025 strategy around strengthening technological capabilities through global centers of excellence. This is backed by a strong track record of launching digital products for instant quotation and booking along with analytics (myDHLi), increasing visibility (Ocean View and Supply Watch), and even implementing blockchain for logistics payments with HP.

In short, these freight forwarders have taken a prioritized, opportunistic, sometimes inorganic, but always customer-centric approach to digitization and it's generally worked well. The incumbents have used these initiatives, combined with customized offerings for specific industries and a strong portfolio of value-added services, to successfully counter the pressure from their tech-driven challengers.

The future of freight forwarding lies in digitization. To alleviate the pressure from challengers and continue growing business, incumbents need to invest more into further strengthening their digital capabilities. They must use what they have today—infrastructure, expertise, information, and relationships—to their advantage in creating an optimal user experience. Given the pace, systems, and network of challengers such as Flexport, incumbents should double down to widen the gap to challengers moving forward.

Impact of COVID-19

An unprecedented number of blank ocean sailings and a steep decline in air freight passenger flights has shrunk 2020 capacity and put pressure on forwarders. Some forwarders, such as Ceva Logistics, have declared force majeure, relieving them of some contractual obligations. Other forwarders are leveraging their networks as much as possible to support essential businesses. For example, DHL Global Forwarding is partnering with healthcare customers to move essential US supplies.

Forwarders are implementing innovative ideas to combat delays due to congestion. For example, Damco has launched a US Cargo Rescue Program intended to help ease congestion at US entry ports as a result of the pandemic. The program includes a "Park and Save" service that pulls cleared import

containers from terminals and stores them until the customer is ready to receive them. Another service removes freight from containers and stores the cargo in a warehouse.

As inventories get depleted and container services start to come back online, economic recovery still seems to be in the offing. If COVID-19 represents a series of disruptions—rather than a trigger for a major global depression—freight forwarders can help proactive shippers navigate current uncertainties, reconfigure trade lanes, and optimize cost impacts across modes.

But COVID-19 issues do point to some bigger-picture, more permanent changes. Just as the trade war caused shippers to think about diversifying their supply base beyond China, the pandemic will redefine global supply chain flows. As specialists with a reputation for adaptability and resilience, freight forwarders must stay on the forefront of these trends.

Summary

As traditional freight forwarders digitize their operations and customer experiences, tech-driven challengers are moving toward expanding physical assets, staff, and office presence. Where once digital forwarder was a niche within the industry, soon it will be the face of the industry.

Success for freight forwarders will depend on them further developing their strengths to assure the best user experience. As COVID-19 continues to create uncertainties and challenge the economic prospects for 2020, the most agile freight forwarders will emerge as the leaders.

Third-party logistics: designs to stay ahead

Third-party logistics providers (3PLs) create value when they, as specialists, can design a complex logistics space better than what shippers can cobble together. In challenging 2019 conditions—and even more so in the 2020 pandemic—ever-faster changes made the logistics space ever-more complex. Meanwhile, however, improving technology increasingly gives shippers the opportunity to construct powerful in-house solutions. Can 3PLs stay ahead?

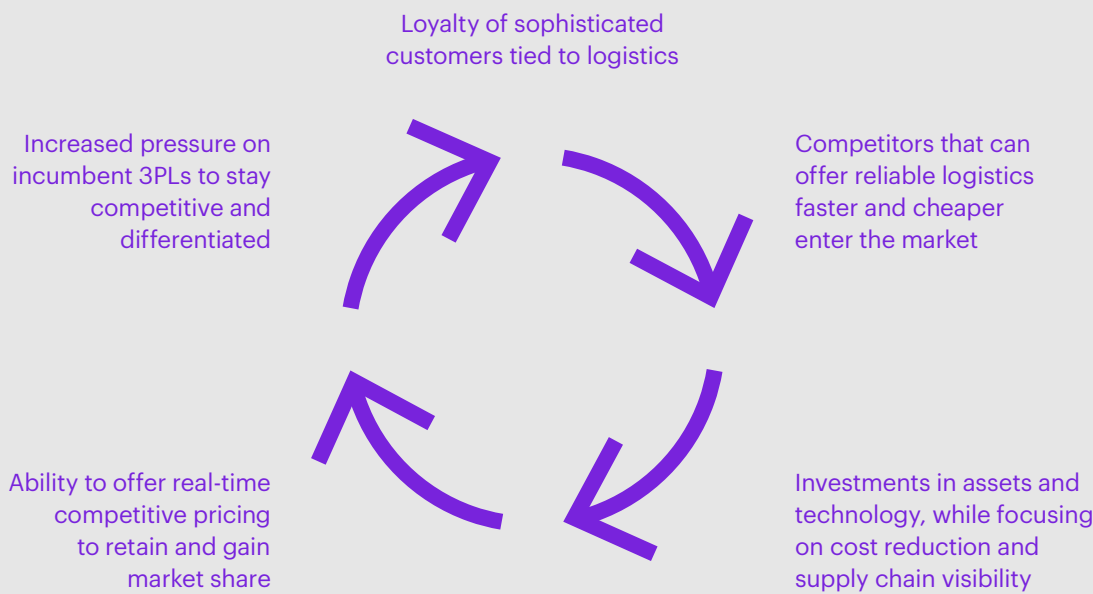
The 3PL industry’s dynamics reflect a virtuous loop of increased customer sophistication, intensifying competition, evolving technology, and resulting pricing pressure that forces incumbents to keep performing better, so it’s not a matter of choice (see figure 29).

Competitive landscape: asset ownership

All 3PLs saw declining or decelerating revenues in a rough 2019 marred by a variety of external factors from protests in Hong Kong to labor strikes in the US to rising storage and labor costs, to pushbacks from e-commerce leaders. Financial results for top 3PLs show that soft volumes led to profitability declines for asset-light companies such as C.H. Robinson and Landstar. On the other hand, asset-heavy companies such as XPO Logistics improved 2019 profitability through smart management of those assets.

Asset-light 3PLs essentially make their money as brokers, matching demand with available supply while adding services such as speed, flexibility, and visibility. To win, they must be very nimble. Given that a 3PL’s greatest strength is its specialist’s knowledge of the market, asset-heavy 3PLs double their bet on that knowledge by also owning those supply assets. To win, they generally need high levels of specialization or scale, but their higher capital expenditures entail greater profitability pressures and risks.

Figure 29
The 3PL industry faces a virtuous loop of continuous incumbent improvement



Source: Kearney analysis

In a stable 2019—with increasingly transparent markets making more sales channels available to all—asset-heavy 3PLs did well. But as shippers seek to move away from cost-plus contracts to gain-sharing, and as 2020 promises downturns and market shifts, the situation becomes more difficult. Asset-heavy 3PLs, especially, must put greater emphasis on productivity and creativity.

If it is a 3PL—and characterizations differ—then Amazon was 2019’s ultimate asset-heavy 3PL. Amazon’s asset base spiked from \$61.8 billion in 2018 to \$97.8 billion in 2019, demonstrating how its e-commerce dominance is co-evolving with its physical presence. In addition to warehousing expansions, Amazon Air greatly expanded in 2019, through both fleet leasing and extension of partnerships with Cargojet and Sun Country Airlines.

Amazon appears to be using these assets to do more than merely continue to move away from dependence on UPS and FedEx. By the end of 2019, Amazon’s third-party seller services revenues (consisting primarily of fulfillment and storage fees) reached \$53.8 billion. That means Amazon has beaten most 3PLs in becoming one of the nation’s largest asset-based shippers.

Shipper-3PL conflicts

Many shippers remain dissatisfied with the relevance of options and capabilities offered by their 3PLs. They express concern that 3PL capabilities often vary significantly by industry, geography, service type, and cost. As a senior executive of a diversified industrial conglomerate puts it, “Major frustration comes from the fact that people from the 3PLs who manage our book of business don’t have the systematic knowledge of the business... and are not specific enough for us.”

These concerns lead shippers to diversify their portfolio of 3PLs. Many Fortune 500 companies use dozens of 3PLs; for example, Procter & Gamble has 53, Nestlé 42, Unilever 36, and GM 51. These large companies run 3PL sourcing events to continuously test cost and performance because they see the risk of switching among their fragmented vendor base as relatively low. Their 3PLs are seeking to show through investment and improved capabilities that a stronger commitment is in order.

Some large shippers use innovative technology to gain insights that help them manage logistics services in-house. As one global logistics lead puts it, “Nowadays, in-house and outsourced... can have almost equal access to technology, which discourages us from outsourcing.” Sophisticated transportation management system (TMS) solutions—including improvements to warehouse management systems and links to enterprise resource planning systems—offer versatile capabilities, from point solutions for data management, pricing, network modelling, and route optimization to a cloud-based integrated platform with API linkages. For example, SAP Logistics Business Network partnered with Project44 and Uber Freight, and Oracle Logistics Cloud partnered with Loadsmart.

Thus, 3PLs have been revamping their digital capabilities, often through stronger collaboration with technology companies. For example, Transplace enhanced its in-house TMS by partnering with Noodle.ai, for the artificial intelligence to match demand signals with dynamic fleet movement; with Riskpulse, for reductions in operational variability; and with Descartes, for real-time shipment visibility. Other 3PLs using intelligent, integrated, and proprietary platforms to gain market share include C.H. Robinson’s TMC with its in-house Navisphere and Redwood with Connect 2.0.

Signs of success are also emerging in the market for 3PL-technology company partnerships such as XPO-Blue Yonder (formerly JDA) and DHL-Oracle, in which both partners focus on their core competencies while combining their strengths for customers. “Our ClearChain technology suite is built on core applications in fleet management, powered by the Oracle TMS, and freight and warehouse management, powered by the Blue Yonder TMS and WMS,” says Marc Althen, president of Penske Logistics.

“We’re all in this together.”

— Major shipper, summarizing multiple shippers’ characterization of 3PL attitudes

Shipper-3PL collaboration

To avoid churn and shipper insourcing, successful 3PLs are fostering collaboration to deepen relationships. For example, consider the five-year relationship between CEVA and Ikea. The partnership began locally in the UK and Australia; in 2019, Ikea announced the opening of a New York e-commerce distribution center managed by CEVA. Similarly, a leading consumer packaged goods (CPG) manufacturer told us that it has found success in outsourcing supply chain elements to 3PLs across the board for planning, sourcing, co-packing, and delivering.

Such shippers are effectively buying talent and innovation from 3PLs. For example, the CPG manufacturer highlighted distinct innovative offerings such as track-and-trace of counterfeits; it appreciated retaining data ownership while staying agnostic to logistics applications. Other shippers have cited incremental improvements in creativity such as the campus model for 3PLs, where multiple shippers are served from the same group of facilities, or the availability of 3PL last-mile networks and extra cross-dock capacity that can quickly serve to help shippers with e-commerce surges.

When 3PLs work on bolstering their shipper relationships, shippers reap benefits. But both parties need to meticulously meet their part of the deal to see success. For shippers, this often includes aiming to become a shipper of choice, partnering to develop vital solutions for carrier integration, and choosing to outsource more planning functions to a trusted 3PL. Shippers and 3PLs that focus on a complementary partnership while continuously investing in their technology, capabilities, and customers will find more success.

Pandemic-tested, shipper approved

The COVID-19 pandemic tested 3PLs like never before. Many faced sudden stops or surges depending on the industries that they served. Most heavy manufacturing, the automotive industry, and important segments of basic chemicals came to a halt as factories closed and demand withered. The 3PLs serving the hospitality and restaurant industries mostly stopped cold. High-tech products such as microprocessors continued to fly across the globe, still needed as inputs to crucial computers, servers, and military products, but heavy premiums were paid. CPG and grocery demand surged as people hoarded and then shopped or took home delivery during shelter-at-home orders.

It was as if 2019 had been an upper-level college course, and the pandemic was the final exam: would 3PLs have the agility, market knowledge, and technological sophistication to respond? In general, they were able to pass the test, with the best 3PLs reporting they were able to redeploy some people and assets from the arrested to the surge-hit industries.

Even more impressively, they generally did so in a spirit of partnership with their collaborating shippers. Shippers reported a sense of solidarity with their 3PLs through the pandemic and reported that the 3PLs had a “we’re in this together” attitude rather than invoking force majeure clauses. This was widespread enough to encourage the expectation that the industry can and will overcome the challenges outlined above.

How to maximize 3PL value

As we’ve seen, 3PLs must bolster resilience while shrewdly investing in technology, market-specific capabilities, and industry- or geography-based scale. Meanwhile, shippers must align their outsourcing strategy with their overall logistics priorities. For most shippers, insourcing capabilities is hard to build and scale, and return on capital can be relatively weak.

The best approach for a shipper to make a wise 3PL choice is to first answer some key questions.

- What is most important to your customers: low cost, delivery speed, or improved visibility?
- How important is control of logistics data, assets, and capabilities to your company?
- How and where will you compete on delivery and what levels of investment are you willing to make internally versus in concert with 3PLs?

Understanding these priorities will determine your future operating model blueprint, including establishing which systems, processes, and resources will improve your operations and satisfy your customers. This broadness of vision, thoroughness in approach, and genuine partnering with 3PLs for a codeveloped solution will determine the real winners and losers.

Pipeline: diverging stories amid uncertainty

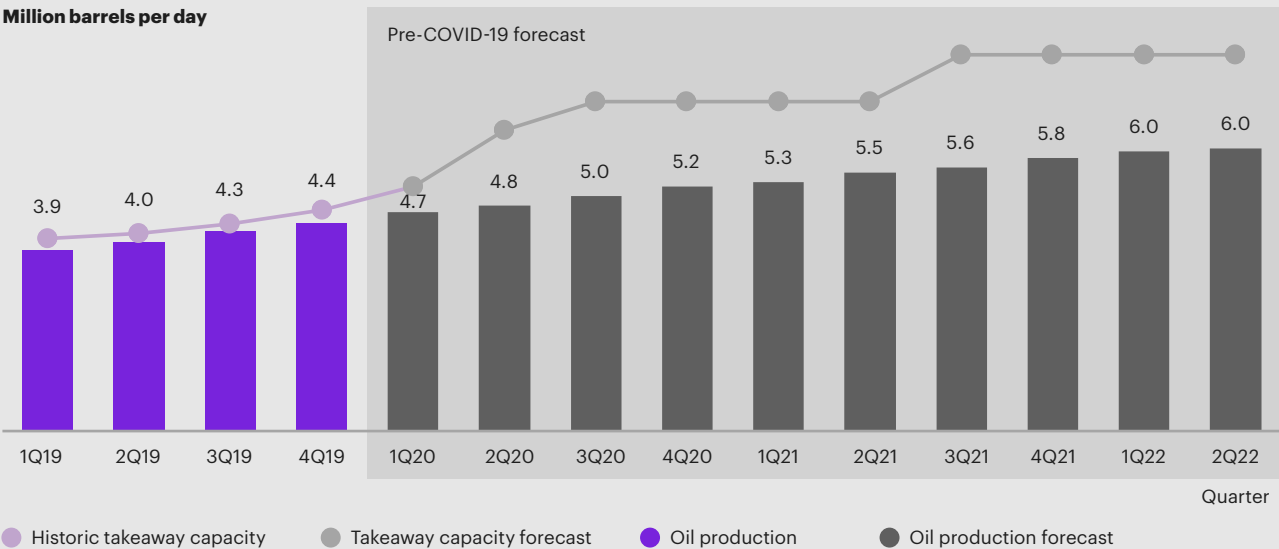
The story of the oil and gas industry has always been about imbalances. It’s hard to achieve an ongoing equilibrium when events move so quickly and there’s such a lag time between investments and their results. This year the imbalances are creating diverging stories in the interdependent oil and gas sectors—further exacerbated by the COVID-19 pandemic.

Although the stories are playing out in a similar fashion across the country, they’re best illustrated in the Permian Basin of Texas. In 2019, Permian oil pipeline capacity finally met demand—and promptly exceeded demand by about 20 percent, or 1 million barrels per day (mbpd) (see figure 30). Overcapacity puts downward pressure on tariffs (the industry name for pipeline transport rates). As the pandemic dramatically reduces oil consumption, production volumes are also decreasing. That leaves even more oil pipeline capacity available, increasing the downward pressure on tariffs.

As the pandemic dramatically reduces oil consumption, production volumes are also decreasing.

Figure 30
Permian oil pipeline capacity finally met—and exceeded—demand

Due to the COVID-19 pandemic, production is expected to significantly decline; future takeaway capacity may also be curtailed.



Sources: Rystad; Kearney analysis

The realization of reduced tariffs will materialize in 2020 due to the lag in pricing. This explains how, in 2019, pipeline USBLC increased by 9.5 percent due to increased domestic oil and gas production, as well as tight capacities and high tariffs early in the year. Indeed, Permian oil production rose from 4 mbpd at the beginning of the year to 5 mbpd by the end of the year. Associated gas production thus, necessarily, also increased (see figure 31). The ensuing shortage of gas pipeline capacity can't lead to higher tariffs because the price of gas itself is so low. The result: Permian gas producers increased flaring by 35 percent (see figure 32 on page 51). As wells age, production becomes gassier, which would further exacerbate the increased gas production. However, the COVID-19 dampening of oil production will decrease associated gas production, reducing the capacity deficit.

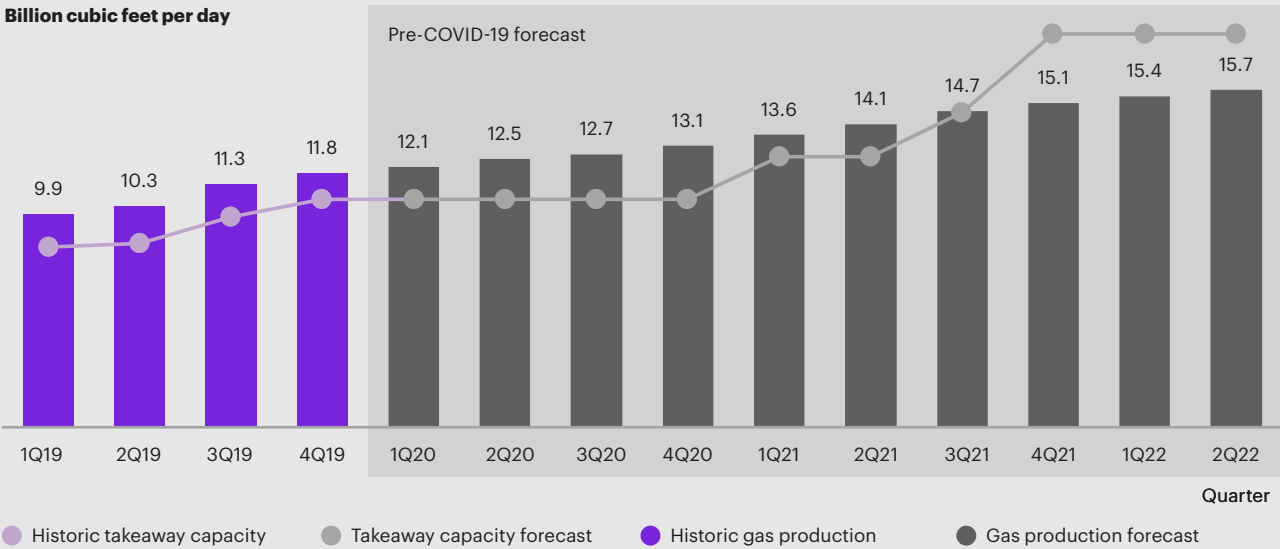
Potential demand-dampening long-term effects of the coronavirus are only the latest uncertainty to further cloud this picture:

— Economically, slowing conditions, which reduce demand for oil, could exacerbate stresses across the industry.

- Geopolitically, however, a conflict in an oil-producing region could lead to increased US production.
- Politically, potential regulation of flaring could increase demand for gas pipeline capacity, although potential regulation of hydraulic fracturing may reduce gas production, thus reducing pipeline demand.
- Structurally, we may (or may not) be on the verge of an energy transition, especially toward the electrification of transport. The transition could lower tomorrow's demand for oil—yet today's large capital projects such as pipelines rely on predictions of that future demand.
- Financially, changing investment structures may reduce investors' appetite for master limited partnerships (MLPs), which could increase the cost of capital and thus further hamper pipeline development. The advantage of MLPs was that they weren't taxed until distributions were made to shareholders. With the latest drop in corporate tax rates, there is little advantage to the MLP structure and investors are less inclined to invest in MLPs. If pipeline investment lags, tariffs on existing pipelines will increase.

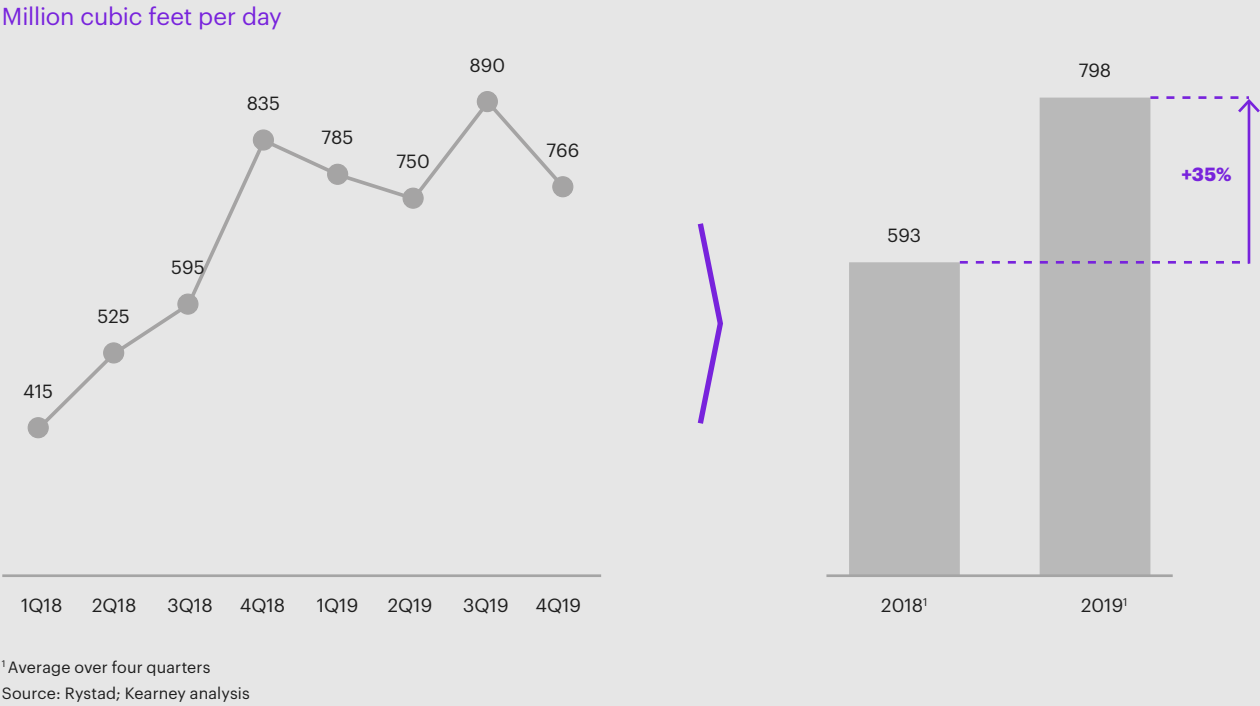
Figure 31
Gas production associated with Permian oil production increased

Due to the COVID-19 pandemic, production is expected to significantly decline; future takeaway capacity may also be curtailed.



Sources: Rystad; Kearney analysis

Figure 32
There was 35% more gas flaring in the Permian in 2019 compared to the previous year



The uncertainties point in varying directions—consistent with the industry’s history of imbalance. In this convoluted setting, an individual company’s success may depend on its creativity in collaborating or consolidating across the industry. For example, some pipeline operators may want to buy or lease capacity from other players; others may want to reduce costs or increase market power through consolidation. Compared to past years—when obvious shortages in Permian pipeline capacity made investment choices easier—today’s more difficult decisions will require deep intelligence and thorough analysis.

As of the date of this writing, the uncertainty regarding the timing of the resolution of the COVID-19 crisis has created a perfect storm in which oil demand decreases, oil pipeline capacity increases, and declining investor appetite all converge at the same time, casting gloomy prospects for the pipeline industry.

The COVID-19 dampening of oil production will decrease associated gas production, reducing the capacity deficit.

5G: the new table stakes

The coming 5G wireless standard will make it easy to put sensors everywhere. Because end customers continually demand greater transparency, reliability, and speed, companies across the logistics landscape will soon use 5G to meet those needs. 5G will power reliable implementations of the Internet of Things (IoT), providing data-driven intelligence. As 5G improves autonomous communication among devices, vehicles, and infrastructure, the rate of automation will accelerate across all logistics operations.

5G has encountered cultural resistance, perhaps because the most-cited immediate consumer benefit—“downloading a movie in seconds”—doesn’t seem worth the hype. But consumer benefits aside, the impact of 5G on enterprise will be profound and will only increase as the network is fully rolled out. The outbreak of COVID-19 will only expedite adoption of digital enablement, automation, and other 5G use cases. Disrupted supply chains and limited person-to-person interaction will accelerate the demand for technology such as enhanced shipment tracking, remote equipment operation, and autonomous warehouse robotics. Telecom deployment for 5G infrastructure remains on track, ready to meet the challenges and opportunities that lie ahead.

The long-term, big-picture implication of 5G will be lower costs and improved performance for entire supply chains. Today’s mobile networks from 2G to 4G (LTE-Advanced) can already support some use cases, but **5G will add new dimensions over time**. The imminent result for every individual company will be required investments in 5G and the technologies it enables.

Why 5G matters

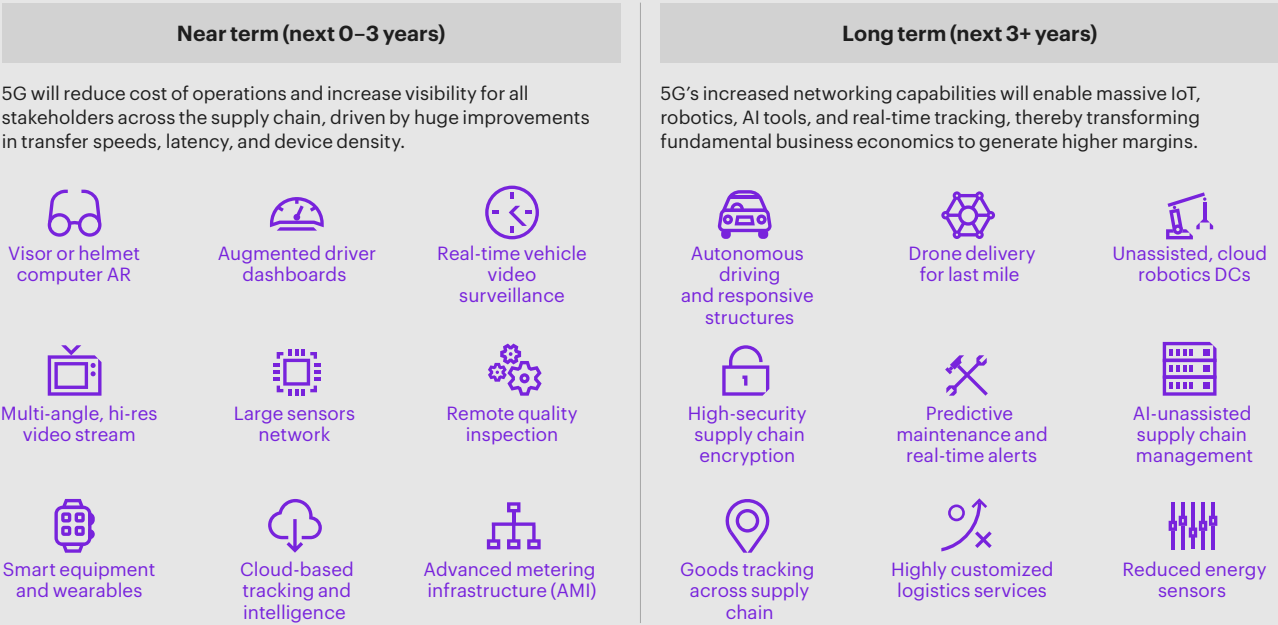
5G’s enhanced mobile broadband network moves your data up to 20 times faster, with lower latency and higher capacity. The benefits from these network advancements will arrive in two stages. Initially, the efficacy of current technologies will be drastically improved to enable enhanced use cases. As the ecosystem around 5G matures, leading-edge technology that fully capitalizes on 5G’s revolutionary capabilities will be introduced into the market. With 5G, the initial low-hanging fruits will center around enhanced mobile broadband (in other words, faster speeds and more bandwidth), applications such as ultra-high-definition video tools, and augmented reality (AR) and virtual reality (VR) operations with tactile feedback.

More broadly, 5G’s continuous high-speed data connectivity provides the secure wireless control you need to achieve Industry 4.0, the Fourth Industrial Revolution centered on automation. Likewise, the 5G improvements in reliability and latency help you achieve seamless communication between vehicles (V2V) and between vehicles and infrastructure (V2I).

Simultaneously, other slices of a 5G network can give you ubiquitous coverage and long battery life for thousands of low-cost sensors. This means you can put IoT devices in infrastructure such as pipelines, smart meters, and warehouse lighting, and in mobile assets such as worker devices, vehicles, and shipping containers. The result will transform asset, shipment, and inventory tracking.

Figure 33 (on page 53) summarizes the many applications of 5G-enabled applications.

Figure 33
5G offers drastic improvements in both the near and long term



Notes: AR is augmented reality. DC is distribution center. AI is artificial intelligence.
Sources: Ericsson, The Industry Impact of 5G, Report ITU-R M.24 10-0; Kearney analysis

What will happen next

5G infrastructure is being deployed quickly. Specifically, new standards of narrowband IoT (NB-IoT) and enhanced machine type communication (eMTC) use existing 4G networks to launch the low-power wide-area 5G networks in 2020. As a result, massive IoT use cases will soon be relevant across all logistics sectors. Additional non-IoT benefits of 5G will also generate advanced use cases, including video and V2I. More advanced use cases are expected to start scaling in the market starting in 2022.

Varying degrees of 5G coverage are expected in 2020, with higher performance in metropolitan areas and select industrial zones. Consistent national coverage is expected in most global markets starting in 2022. Higher bandwidth spectrum for better performance will be continuously rolled out through 2028.

With 5G, sensor batteries can last 10 years, and sensors can effectively be placed everywhere. The resulting demand will allow sensor manufacturers to increase scale, thus lowering prices and leading to even more demand. IoT economics will soon become very favorable.

Those favorable economics will meet a rising consumer demand for visibility into supply chains. Logistics providers will be able to meet that demand by automatically labelling, tracking, and recording all logistical elements, including an item’s location, temperature, humidity, g-forces, and more. You will be able to see incidents and make contingency plans.

Because 5G will support automation and reduce losses through better tracking, you will gain efficiency benefits. Early adopters and new niche players will lower their costs more quickly. In a competitive environment, they will pass savings on to consumers through lower prices—and thus force their competitors to play catch-up. The 5G-enabled streamlined and transparent supply chain will become table stakes to compete in logistics.

Figure 34 shows how benefits will play out for various key players across three logistics functional areas: operations execution functions involving daily business operations, planning and management to inform business strategy and orchestration, and additional services related to nascent offerings and ancillary functions beyond traditional logistics.

How you can benefit

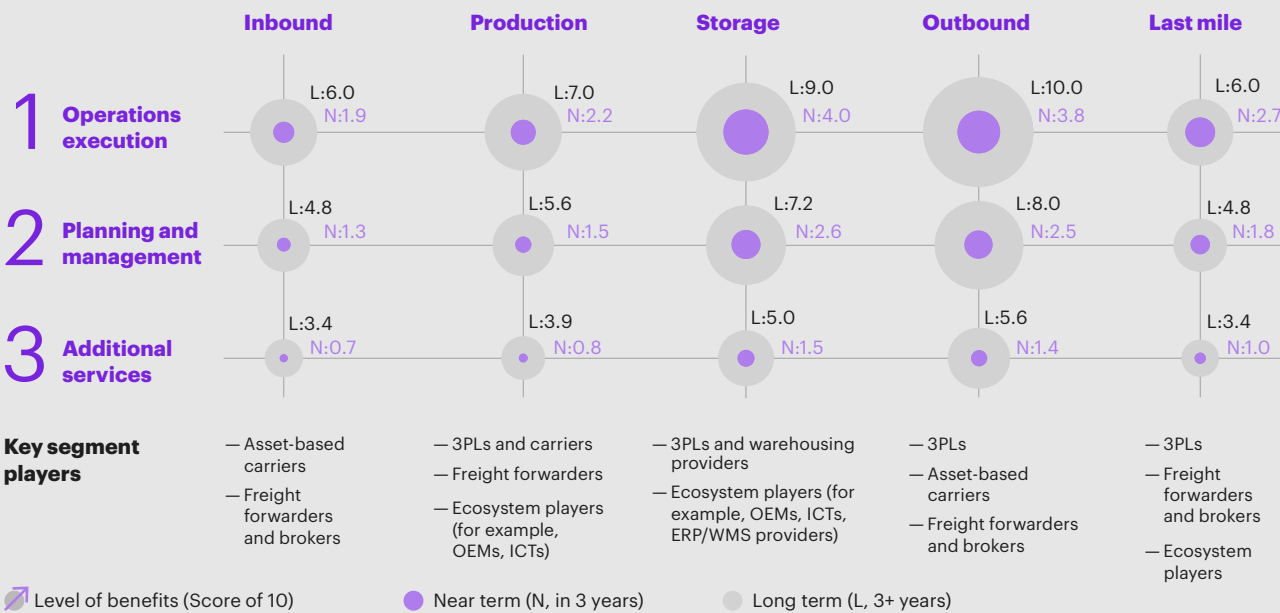
Let’s take a closer look at 5G benefits for different types of logistics companies:

1. Asset-based carriers such as motor, air, rail, or ocean carriers will gain from autonomous vehicles and IoT devices. 5G helps self-driving vehicles communicate, and those vehicles are more cost-efficient than human-operated vehicles. IoT devices will provide real-time tracking of products, noting environmental risks for sensitive goods. IoT devices can also track the carrier’s own assets to improve predictive maintenance.

2. Freight forwarders and brokers with limited assets can improve planning and scheduling with asset tracking. They won’t gain the capex benefits of asset-heavy companies but are positioned to take advantage of precise information and improved cost effectiveness. Benefits of 5G technologies will help them develop new, high-value logistics services, using more enriched data from IoT devices, enhanced real-time video monitoring, and quicker execution through automation in operations hubs.

3. Warehousing providers and 3PLs can deploy integrated systems of IoT devices in warehouses. They will gain an abundance of real-time data to improve operational decision-making, for example through smart inventory management, better asset utilization, predictive maintenance, and reduced workplace accidents through enriched communication. 5G improves AR and VR functions, including vision picking with hands-free AR glasses. 5G will also enable new solutions for last-mile delivery, including drones and delivery robots.

Figure 34
The benefits of 5G will be seen across the logistics value chain



Notes: Benefits level score provided for each instance with maximum score of 10.0. OEM is original equipment manufacturer. ICT is information and communications technology. ERP/WMS is enterprise resource planning/warehouse management system.
Sources: GSMA Intelligence reports, Ericsson reports, Report ITU-R M.24 10-0; Kearney analysis

4. Logistics ecosystem players such as equipment manufacturers, ICT providers, and software solution providers will see increased demand for 5G-based offerings. For example, the global IoT market will reach \$1.1 trillion by 2026, mostly in the form of devices, according to Fortune Business Insights. Likewise, manufacturers of warehousing equipment as well as warehouse software providers will benefit from incorporating 5G connectivity into their products. Telcos are expected to increasingly set up [5G networks for private industrial use](#). Such advances will accelerate current trends toward increased automation across the value chain.

Figure 35 (on page 56) presents case studies for sample players in each of these sectors. These examples represent leading-edge applications and experimentation—the true rate of adoption will depend largely on economics that vary by market and region.

Taking advantage of 5G’s innovations may force you to change your business model, infrastructure capabilities, and current processes.

What you need to do

Moving from 4G to 5G isn’t just about increasing data throughput. It’s about discovering a universe of powerful applications. So you want to think about which 5G applications can best support your company’s strengths, and how.

To execute new technologies, augment automation, improve cross-functional coordination, and increase speed to market, you may need to alter current ways of working. In short, taking advantage of 5G’s innovations may force you to change your business model, infrastructure capabilities, and current processes. It can be hard, especially for market leaders compared to smaller, agile competitors. Yet 5G will create opportunities you can’t ignore.

There are hundreds of potential 5G use cases. Only a few will fill crucial gaps or solve your particular problems. The first thing to do is decide what to do first. Once you choose projects, you can determine their order, assess the investments required, and find the best vendors.

5G implementation doesn’t happen in a vacuum. You need to orchestrate with your workforce and IT planning: Are you collecting the right data and making the right decisions? Do you have the right capabilities for big data, storage, and security? Can you find or train the talent to enable your future value chain?

Your 5G success will depend on the readiness of your suppliers to upgrade your infrastructure and capabilities. Do you have the right partners? For that matter, you should also be assessing your customer base to determine where a 5G-powered performance boost would serve as a differentiator.

Finally, logisticians must treat this as an ongoing process. With 2G, 3G, and 4G, the best stuff—the killer use cases—didn’t emerge until after the rollout. Likewise with 5G, it’s possible that nobody has yet imagined the best ways to take advantage of higher speeds and connectivity. You must actively seek out how to evolve and what to adopt, developing the agility to respond to novel approaches.

Figure 35
5G will benefit different types of logistics companies in different ways

Asset-based carriers	Freight forwarders and brokers	Warehousing providers and 3PLs	Logistics ecosystem players
<p>CMA CGM</p> <p>Uses 5G to optimize operations through its TRAXENS smart container IoT technology</p> <ul style="list-style-type: none"> — Enables customers to manage their supply chain in real time — This tech has been emulated by other ocean carriers, suggesting future standardization <p>Cal Freight</p> <p>Deployed connected tablets across its fleet to easily capture driver and trucking data</p> <ul style="list-style-type: none"> — Creates safer work environment by complying with federal electronic logging device (ELD) rule — Provides insights into how to efficiently manage and scale its business <p>Port of Livorno, Italy</p> <p>Partnering with Ericsson to build a connected port where devices, machines, and humans share information in real time</p> <ul style="list-style-type: none"> — A container unloaded from a vessel could communicate directly with unmanned ground vehicles for loading and unloading operations 	<p>DB Schenker</p> <p>Partnered with Einride, Ericsson, and Telia to use 5G-enabled electric autonomous vehicles</p> <ul style="list-style-type: none"> — The vehicles autonomously transport goods between a warehouse and terminal at a Swedish DB Schenker facility, operating continuously without human input <p>Panalpina</p> <p>Expanded its Logistics Manufacturing Services (LMS) offering into the telecom installation market in Mexico</p> <ul style="list-style-type: none"> — Provides telecoms with an integrated solution to deliver and install network components for 5G cell sites <p>DHL</p> <p>Developed the DHL SmartSensor, an IoT sensor to provide location and condition monitoring during shipping</p> <ul style="list-style-type: none"> — Monitors temperature, humidity, shock, and light to ensure integrity during transportation 	<p>XPO Logistics</p> <p>Deployed 5,000 robots to warehouses to make operations safer and more efficient</p> <ul style="list-style-type: none"> — Technology works in conjunction with human packers to shorten order-to-shipment times — Robots lift heaviest loads, improving safety <p>JD.com</p> <p>Launched China's first 5G-powered smart logistics park in Beijing</p> <ul style="list-style-type: none"> — Real-time monitoring of forklift and pallet location, providing preemptive alerts when necessary — Monitoring system detects and analyzes <p>Honeywell</p> <p>5G being used to enhance performance of Honeywell's Vocollect headset in warehouses</p> <ul style="list-style-type: none"> — 5G increases the reliability and functionality of headsets widely used to guide warehouse workers in picking products — Network slicing provides the ability to prioritize device traffic, ensuring quality of service for vital applications 	<p>Sprint</p> <p>Launched Sprint IoT factory, a marketplace of IoT solutions for small and medium-sized businesses (SMBs)</p> <ul style="list-style-type: none"> — Provides plug-and-play solutions for IoT needs to help SMBs add IoT tech to their businesses — Comprehensive portal to guide decision-makers to the right solution to meet their needs <p>Verizon</p> <p>Corning is using Verizon 5G at a manufacturing facility to test factory automation and quality assurance</p> <ul style="list-style-type: none"> — 5G-connected cameras wirelessly track and inspect inventory — Autonomous-guided vehicles transport parts around the factory floor <p>SAP</p> <p>Partnered with Verizon's ThingSpace to collect and analyze data for supply chain management</p> <ul style="list-style-type: none"> — Enables time-series analysis enhanced with master data, geolocation, and environmental conditions for outbound logistics processes to automatically generate service calls

Note: IoT is Internet of Things.
 Sources: Industry reports and press releases; Kearney analysis

Logistics trends and outlook: why tech matters

Most sectors of the logistics industry are characterized by tight margins. To succeed, logistics companies have to become more efficient, a quest that is closely tied with data. The very nature of the industry—getting an item from one place to another—abounds with data on the item’s changing location, data on the assets used to aid in its journey, and data on costs. Technology is good at manipulating data. But largely because of the industry’s fragmented nature, huge amounts of data continue to be handled by outdated, inefficient, disconnected, manual processes—or not handled at all.

Markets are well aware of this inefficiency. That’s why so much investment goes into global supply chain and logistics technology start-ups—more than \$13 billion in 2019 alone, with more than 40 percent of that going to US-based start-ups. Established logistics companies know this too. That’s why they too are making hefty investments to modernize and innovate within their existing infrastructure and processes.

The implications of the COVID-19 crisis have reemphasized the value of technology in logistics. Logistics companies that may have previously regarded investments in such digital technologies as shipment location tracking or electronic signatures as unnecessary are now being forced to reevaluate.

Winning companies will emerge from this crisis with more digitally savvy logistics operations. The most vital need that digital solutions will fulfill is the need to reduce dependency on physical labor across modes and nodes in logistics. This will be enabled by robotics for moving and handling goods, autonomous devices such as drones, and AI- or ML-supported forecasting, sales, and order management processes, among other technologies.

In this section, we take a closer look at select high-impact technologies that will shape logistics in the coming years. These technologies have been selected based on general population interest, media impressions, venture capital funding investment, and Gartner Hype Cycle scores over time. While the level and nature of interest in these technologies may have varied over time (for example, after an initial explosion in interest in blockchain, talk has slowed due to challenges with implementation; meanwhile, as autonomous vehicles enter a phase of maturity, the nature of commentary has shifted from hype to action), the relevance of these technologies in terms of their impact on logistics grows, even more so in a post-COVID-19 world (see figure 36 on page 58 and figure 37 on page 59).

Artificial intelligence and machine learning

Artificial intelligence (AI) and machine learning (ML) are broad categories, which companies across all stages of logistics are already using to make smarter and quicker decisions. AI and ML directly address the data challenge, helping companies turn existing data into better insights and competitive advantage. Their importance to the industry is why 20 percent of the AI 100 (CB Insights’ annual ranking of the world’s 100 most promising AI start-ups) are in logistics.

The most vital need that digital solutions will fulfill is the need to reduce dependency on physical labor across logistics.

Companies can use AI and ML to:








- **Anticipate** market changes to make better planning decisions
- **Predict** high-demand products, so that warehouses can move them to easy-to-access locations
- **Optimize** delivery routes based on real-time traffic and weather conditions
- **Recognize** damaged goods before they get delivered
- **Automate** simple, repetitive back-office tasks to reduce paperwork, improve productivity, and reduce errors

Although the industry recognizes the tremendous benefits that AI and ML can bring, one hindrance to more widespread adoption is that in general you first need usable, clean data—and that’s often not available. This challenge is being overcome by the rise of AI technologies to clean data, so we do expect AI and ML adoption to accelerate.

A great example of AI and ML in action is how Werner Enterprises is incorporating technology into its everyday processes. For many of Werner’s tasks, making the best choices requires lots of input data. For example, selecting the best carrier means combing through thousands of possible trucks, routes, and schedules. Werner uses AI and ML tools to identify two or three best options for a human decision-maker to consider—a narrowing that takes seconds rather than minutes, as it did previously. Werner CEO Derek Leathers told Forbes.com, “We’re putting a lot of money into ML and AI to augment the human role in capacity optimization, mode selection, [and] carrier selection.”

AI and ML will likely continue to be dominant disruptive forces in logistics for years to come. The value they bring is clear, barriers to entry are lowering, computing power continues to grow, and ever more data is ever more widely available.

Figure 36
A number of high-impact technologies will shape the logistics industry in the coming years

Time to market	1–3 years	3–5 years	5+ years
Technologies and estimated impact on logistics	Artificial intelligence and machine learning 	Robotics 	Renewable energy (for example, electric trucks) 
	5G and Internet of Things (high-speed connectivity and small-scale IoT) 	Augmented reality and virtual reality 	Blockchain 
		5G and Internet of Things (ultra-reliable connectivity and large-scale IoT) 	

Impact:  Low  Medium  High

Source: Kearney analysis

Figure 37
Advanced technology is being utilized across the logistics industry

	Snapshot of recent developments
AI and ML	<ul style="list-style-type: none"> — Evans Distribution Systems, a provider of third-party logistics and supply chain solutions, is transforming its warehouse packing line with a machine vision AI solution from ADLINK Technology, a global leader in edge computing. The company has deployed the ADLINK Edge Smart Pallet solution to improve accuracy and efficiency; package contents are recorded and classified as they move along the packing line and rule-based analytics are able to identify any incorrect contents. — San Francisco drone start-up Ware is using drones and sophisticated software to handle inventory tracking for the warehouse industry. The Ware solution uses a drone to capture images of warehouse bins and then uses machine learning algorithms to process the images.
Robotics	<ul style="list-style-type: none"> — Unbox Robotics, an early stage start-up, is building a logistics automation system that could enable logistics players to automate and improve their operations on demand with limited footprint and capital. It recently received \$550K in seed funding. — DHL deployed about 100 warehouse robots manufactured by Locus Robotics at 10 US warehouses. Locus robots function as delivery vehicles inside a warehouse; armed with plastic bins, they roll through the aisles and collect merchandise from workers who pluck merchandise from the shelves.
AR and VR	<ul style="list-style-type: none"> — The Port of New Orleans launched its digital Learning Toolbox aimed at educating Louisiana students about the role that the local maritime industry and the Port play in their everyday lives. The Toolbox provides resources for a variety of age groups and includes a 20-minute video of the Port’s “Port 101” presentation and a 360-degree virtual reality video, which showcases day-to-day operations at the Port’s cargo terminals. — FedEx Ground uses VR in employee trainings to better prepare and retain workers. FedEx partnered with Strivr, a VR training systems company, to develop the program, which uses immersive digital environments and sensors to guide and monitor workers as they complete simulations.
IoT and 5G	<ul style="list-style-type: none"> — MHS (a provider of material handling automation and software) launched MHS Insights, a condition-based maintenance solution that monitors assets through IoT sensors and system data to provide timely maintenance recommendations and strategic health assessments. — Aeler Technologies developed a 20-foot shipping container using an IoT-based software platform from Foundries.io, enabling companies leasing its containers to view not only where their goods are located, but also the environmental conditions. — Nokia and the Port of Zeebrugge completed the first phase of a 5G-ready, industrial-grade private wireless network deployment. The network is now being used for connectivity with tugboats, air pollution detectors, and security cameras.
Renewable energy	<ul style="list-style-type: none"> — CNG Fuels has unveiled two new refueling stations in Europe to provide renewable biomethane compressed natural gas. The new refueling hubs in Warrington and Northampton are capable of refueling more than 1,000 HGVs per day. — Associated British Port invested in a fleet of electric forklifts at Port of Hull as part of an ongoing effort to reduce emissions and make more use of renewable energy generated at the port.
Blockchain	<ul style="list-style-type: none"> — Nippon Express plans to invest up to 100 billion yen—approximately 1 billion USD—into a blockchain-based transportation network for pharmaceuticals. It intends to develop its own line of drugs starting in 2021, which will require real-time tracking of products through warehouses and status updates for the quality control teams. — Israel Ports Company has begun pilot testing a system for transferring bills of lading using blockchain technology. The technology is expected to prevent forgeries and documentation delays. — Ocean carriers CMA CGM, COSCO Shipping, Hapag-Lloyd, and OOCL have agreed to work with port operators to produce a blockchain-driven data exchange open to all stakeholders along the supply chain.

Notes: AI is artificial intelligence. ML is machine learning. AR is augmented reality. VR is virtual reality. IoT is Internet of Things. HGV is heavy goods vehicle.
 Source: Kearney analysis

Robotics

Two of the logistics industry's biggest recent challenges have been how to address the massive increase in demand due to e-commerce sales and how to address labor cost inflation in many developed countries. Robotics offers the possibility of supplementing human workers to address both these challenges.

Robotics and automation technologies can be broken into two categories: moving goods and handling goods.

- **Move.** Autonomous trucks are likely to develop in stages: first platooning, then driverless platooning, then full-blown autonomous vehicles operating at scale without drivers all the way from loading to delivery. Similar, but lower-impact, effects can be expected in rail, air, and warehouse drones.
- **Handle.** In warehouses, robotic shelves can move goods to picking stations, picking systems can use robotic arms with sensors to effectively grasp many shapes of objects, and autonomous palletizers can robotically build pallets from units and cases.

Autonomous vehicles still need to make significant headway on safety and regulatory issues. Numerous stakeholders need to come together to build the vision of a driverless world, which is likely still years away. Platooning will come first, in three to five years, and fully autonomous vehicles will become a reality in about 10 years.

However, the handling technologies focused on picking, sorting, and palletizing are already in full swing. Companies such as Amazon are ahead of the curve with robotics investment and are reaping the benefits. At Amazon's warehouses across the world, more than 200,000 mobile robots work alongside employees and have cut operating expenses by almost 20 percent, savings that allow Amazon to invest further in its supply chain.

The challenge with investing in warehouse robotics is that a small number of companies are currently innovating in the space, and an even smaller number have achieved sufficient scale to fulfill the needs of large logistics companies. However, that is changing with significant funding activity under way. As a result of these investments, larger companies will emerge that are better able to meet demand, and logistics companies should be surveying the robotics landscape for useful technologies.

Augmented reality and virtual reality

Augmented reality (AR) and virtual reality (VR) can make processes more efficient, thus improving productivity, especially in warehousing and delivery:

- The earliest examples have focused on aiding warehouse product picking by displaying instructions on smart glasses for items in the field of vision. Glasses can also provide instructions for employees performing maintenance tasks. Eventually they could even help employees find the right pallets when loading or unloading a truck. The approach can reduce lead times, error rates, and job training requirements.
- Similar approaches on vehicle windshields could aid delivery people, perhaps even by showing a picture of the package's intended recipient.

Companies such as Vuzix, Recon (acquired by Intel), and X Development (formerly Google X) are leading the charge on industrial smart glasses, and companies such as DHL that have adopted "vision picking" solutions are seeing improved productivity. However, to achieve widespread AR and VR adoption, glasses and other hardware must be comfortable to wear, not overheat, and have batteries that last an entire shift. Other stumbling blocks may include connectivity (can glasses quickly receive data anytime, anywhere?) and industry-specific or regulatory requirements (is shatterproof glass needed? will transmitting pictures of package recipients lead to privacy concerns?).

In the near term, AR and VR will likely remain limited to existing use cases in warehouse product picking and training—although it will likely expand from early adopters to other competitors in those areas.

5G and the Industrial Internet of Things

Companies can use the new 5G wireless standards in three key ways:

- **End-to-end visibility.** 5G will enable companies to deploy many more devices, creating an Industrial Internet of Things (IIoT) that can provide real-time data for container-, truck-, and SKU-level tracking.
- **Enhanced routes and schedules.** Better tracking will help organizations avoid delays, eliminate unnecessary trips, and optimize routes and schedules in real time.
- **Improved maintenance.** The 5G network will support VR and AI technologies to improve on- and off-road maintenance.

5G networks will soon be ubiquitous. However, beyond the 5G-powered infrastructure on which copious devices can communicate, achieving full IIoT benefits also requires easily available low-cost devices and the emergence of standards for their communication across the network.

Developing and implementing the standards will take time—but that doesn't mean that companies shouldn't act now. The adoption of 5G is going to be a long-term, ongoing process of implementing the infrastructure, the devices, and then the apps to use them—and that process can't begin until early adopters step forward and start logging some wins.

Renewable energy

Logistics companies can benefit from renewables through savings in fuel and power, reducing emissions to meet consumer preferences, and potentially increasing delivery windows through quieter electric fleets. Innovations can be broken into three areas:

- **Electric trucks** rely on battery innovations that reduce costs and charging times (for example, swappable batteries). Hybrid or fully electric trucks from Volvo, Navistar, Tesla, and Thor are expected to reach the market in the next three to five years.
- **Electrified last-mile vehicles** may include handcarts, tricycles, or medium-sized vans. In Germany and other European countries, cargo bikes such as the DHL Cubicycle already handle many inner-city delivery routes.
- **Green warehouses** reduce carbon footprints through rooftop solar panels, smart motion sensors to reduce illumination requirements, and forklift charging in off-peak hours.

Note that electric vehicles themselves do not represent renewable energy so long as most electricity comes from fossil fuels. However, they shift energy usage to a mode that can more easily convert to renewables. Indeed, by 2021 solar and wind will produce more US power than coal, according to projections from the Institute for Energy Economics and Financial Analysis.

Significant barriers exist to fully implementing these technologies. The electric vehicle infrastructure is fragmented and as yet has little government or regulatory support; manufacturers are limited and small-scale. The true power of renewable energy will likely affect logistics only in five to 10 years when all the required infrastructure becomes commonplace. Nevertheless, companies can keep an eye on market developments, so they are not late to the game while considering the benefits for their image by being early adopters.

Blockchain

The benefits of blockchain technology are compelling but also subject to great hype. There's no doubt that blockchain's decentralized nature and transparency can improve tracking and reduce inefficiencies in logistics. But advocates often overlook the foundation of digitization needed to extract the full potential of the technology. There are also technical issues. For example, a smart contract won't self-execute without connectivity at the point of delivery to log the fact that the goods were delivered. And there are trust issues. Making all data in a network transparent to all users can undermine trade secrets. These and other issues surrounding blockchain in logistics are certainly solvable. But it may take years for the solutions—and the changes in a wider ecosystem that they require—to be ready to live up to the hype.

Commendable efforts are nevertheless showing paths forward. For example, in 2019 Walmart Canada implemented a blockchain-based freight invoice and payment reconciliation solution. Walmart and its carriers were able to align their interests: Walmart gains transparency into information, while carriers gain timely payments and better reconciliation. All players gain efficiency and trust—the only disadvantage is that these benefits are limited to this small network. The greater benefits of a larger network will require disparate players to unite and solve more challenges.

Summary of technology trends

The COVID-19 crisis serves as a reminder of the world's reliance on logistics to deliver regardless of circumstances. The crisis also accentuates some of the industry's challenges, especially in meeting increased e-commerce demand from customers. It highlights the need for modernization and technological advances.

Shippers now have vivid evidence of the value of diversifying a supply chain to prevent overreliance on a particular region or player. New, multi-option supply chains with upgraded technology and visibility may cost a bit more in the short term, but will mitigate risks.

For carriers, those diversified, option-heavy supply chains will only increase operational complexity—and thus emphasize the importance of mastering data and digitizing processes. Whether it's AI, robotics, 5G, or other technologies, logistics firms will need strong capabilities to adapt and win in a competitive marketplace and pace the evolving needs of consumers.

The COVID-19 crisis highlights the need for modernization and technological advances.

Outlook for the industry

Growth. As the US economy braces for the full impact of COVID-19 effects, the logistics market outlook is decidedly mixed, but overall brighter than other sectors of the domestic economy. Groceries and e-commerce lead the way, with increased demand for food, beverages, and household goods. Consumers throughout the United States are continuing to buy at a brisk pace. Consumption patterns have substantially stretched capacity, especially as imports from China rebound as the country's production facilities move back online.

Macroeconomic predictions are difficult, given the lack of recent pandemic precedents. Much of the impact will depend on the severity and longevity of the coronavirus outbreak. If its effect on the US economy is contained, we could see a relatively temporary disruption. If its timeline is extended or its effects are severe, the US economy could slide into a recession, muddying the projected freight outlook.

Capacity. The disruptions of COVID-19 have scrambled capacity across all logistics sectors. With passenger flights grounded and ocean carriers blanking sailings, available capacity has remained tight. Thus, despite temporary economic slowdowns, prices have remained high—and indeed could increase as the economy gets moving again. The key words are volatility and imbalance. The early-2020 volatility in Chinese imports have created imbalances in, for example, ocean shipping container locations; expected future volatility in consumer demand will create other imbalances. The only relatively steady-state logistics sectors are warehousing, where booming e-commerce results in continuous under-capacity, and pipelines, where new construction and low oil prices have created massive overcapacity.

Geopolitical forces. Among the least-studied effects of COVID-19 are the psychological ones. Will the pandemic cause people and nations to turn inward, exacerbating past international trade tensions? Or will it underscore the value of working together? Will the Saudi–Russia feud drive oil prices ever lower, or will those low prices prompt that feud to heal? As shippers seek to diversify their supply chains, relying on multiple options in multiple geographies, geopolitics will become ever more crucial to their decisions. Yet amid the pandemic, Brexit, and the coming US election, the geopolitical future is remarkably unclear.

Regulation. For four years, the logistics industry had known about the January deadline for the IMO 2020 sulfur regulations. Nevertheless, many ocean carriers waited until the last minute to decide how to respond—and by March, falling oil prices were prompting some to change their minds. In short, here's one example where long-term planning for regulatory changes turned out to be rather unimportant. If this is an industrywide characteristic, its replicability may be tested soon. Today, the Trump administration is seeking to ease environmental, health and safety, and financial regulations, even more so in response to COVID-19. For example, truck drivers hauling emergency supplies have gained unprecedented relief from hours of service regulations. But November's election could change all that.

In sum, the coronavirus pandemic has thrown the global economy into turmoil. All actors are scrambling to react promptly. The need for agility has never been more clear. Yet in some ways the COVID-19 crisis is accentuating industry trends that were already clear. Risk is taking its place alongside efficiency as a paramount issue in supply chain design, with associated logistics implications. E-commerce is continuing to grow, reshaping logistics and its future challenges. And consumer demand remains the driver, the overwhelming reason that both shippers and carriers must strive to consistently improve.

Authors



Michael Zimmerman
Partner, New York
michael.zimmerman@kearney.com



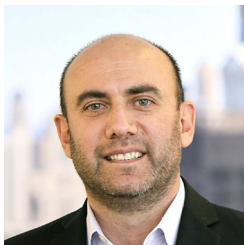
Balika Sonthalia
Partner, Chicago
balika.sonthalia@kearney.com



Alberto Oca
Partner, Washington, D.C.
alberto.oca@kearney.com



Arsenio Martinez-Simon
Partner, Washington, D.C.
arsenio.martinez@kearney.com



Korhan Acar
Principal, Chicago
korhan.acar@kearney.com



Yan Sun
Principal, Chicago
yan.sun@kearney.com

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Estimating USBLC

The CSCMP and Kearney strive to maintain maximum transparency and consistency. The assessment of assumptions, data sources, and methodologies that was made last year resulted in a robust research procedure that can be replicated for consecutive years. Because the structure of the supply chain did not significantly change compared to last year, it was deemed appropriate to keep the approach to estimate the USBLC unchanged.

Historical comparability has been preserved and the three main categories of the past have been retained: transportation costs, inventory carrying costs, and other costs (see figure A on page 66).

Transportation costs

Transportation costs are based on Bureau of Economic Analysis (BEA) industry output. BEA US input-output accounts are a primary component of national income and product accounts and GDP. BEA uses the widest variety of available source data as input to the industry accounts. It incorporates domestic and import-export revenues where applicable. In other words, it includes any spend attributable to an establishment within the United States. It is rebalanced every five years against US Business Census data.

Our data partner IHS Markit used detailed BEA data, its proprietary databases IHS Markit Transearch™ and IHS Markit Business Market Index, and public company information to categorize subsegments in a way that better reflects how transportation and logistics is purchased and used. Data was thoroughly reviewed to avoid double counting between segments.

No changes were made to last year’s segmentation and definitions:

- Motor carriers are segmented into full truckload, less than truckload, and private or dedicated carriers.
- Parcel includes US-based couriers and messengers and the USPS parcel segment, net of purchased transformation. The numbers are based on BEA output, modified to remove duplicate transportation from other modes (arising from, for example, intramode purchases).
- Air freight includes both cargo and air express. Consistent with BEA definitions, it incorporates both domestic and import-export revenues.
- Water includes coastal and Great Lakes, inland waterways, and deep sea. It incorporates domestic and import-export revenues.
- Pipeline reflects all commodity products.
- Freight forwarder is included, net of purchased transportation cost estimates, under carriers’ support activities in the “Other costs” category.

Figure A
Three cost categories are used to determine USBLC

Data element	Sub-elements	Source
Transportation costs		
Motor carriers	<ul style="list-style-type: none"> — Full truckload — Less-than-truckload — Private or dedicated 	<ul style="list-style-type: none"> — BEA input-output accounts, annual, production of commodities by industry — IHS Markit Transearch™
Parcel	<ul style="list-style-type: none"> — Courier and messenger — USPS parcel segment 	<ul style="list-style-type: none"> — BEA input-output accounts, annual, production of commodities by industry, gross value — IHS Markit — FedEx and UPS financial statements — US Bureau of Transportation, Form 41 Air Carrier Reports — USPS financial statements — USPS Cost Segment and Components Report
Rail	<ul style="list-style-type: none"> — Carload — Intermodal 	<ul style="list-style-type: none"> — BEA input-output accounts, annual, production of commodities by industry — IHS Markit — Association of American Railroads — Surface Transportation Board
Air freight	<ul style="list-style-type: none"> — Domestic and import-export cargo and express 	<ul style="list-style-type: none"> — BEA input-output accounts, annual, production of commodities by industry — US Bureau of Transportation, Form 41 Air Carrier Reports — IHS Markit
Water	<ul style="list-style-type: none"> — Inland — Coastal and Great Lakes — Deep sea: domestic, import-export 	<ul style="list-style-type: none"> — BEA input-output accounts, annual, production of commodities by industry — IHS Markit
Pipeline	<ul style="list-style-type: none"> — Crude oil — Natural gas — Other products 	<ul style="list-style-type: none"> — BEA input-output accounts, annual, production of commodities by industry — IHS Markit
Inventory carrying costs		
Storage		<ul style="list-style-type: none"> — BEA input-output accounts, annual, production of commodities by industry — Statista, US warehousing and storage gross output from 2000 to 2019
Weighted average cost of capital	<ul style="list-style-type: none"> — Cost of equity, debt, and taxes 	<ul style="list-style-type: none"> — Aswath Damodaran, New York University Stern School of Business
Total business inventory		<ul style="list-style-type: none"> — Federal Reserve Bank of St. Louis, Series ID A371RC1Q027SBEA: private inventories, quarterly, seasonally adjusted (from BEA). Private inventories includes manufacturing, retail, and wholesale and represents end-of-month stock and goods available for sale on the last day of the reporting period.
Other (obsolescence, shrinkage, insurance, handling, others)	<ul style="list-style-type: none"> — Shippers’ administrative costs 	<ul style="list-style-type: none"> — Kearney estimate based on various internal and external studies — Gartner
Other costs		
Carriers’ support activities	<ul style="list-style-type: none"> — Freight transportation arrangement — Packing and crating — Marine cargo, port, and other shipping-related services — All other support services to transportation 	<ul style="list-style-type: none"> — BEA input-output accounts, annual, production of commodities by industry — Public company financial statements — IHS Markit Business Market Index
Weighted average cost of capital	<ul style="list-style-type: none"> — Wages — Benefits — IT costs 	<ul style="list-style-type: none"> — BLS, occupational employment statistics, occupation by industry sector — BLS, employer costs for employee compensation, private workers — NYU

Source: Kearney analysis

Inventory carrying costs

Inventory carrying costs are calculated from the bottom up using the sum of their three subcomponents: storage, financial costs, and other. Financial costs estimates the weighted average cost of capital for all US public companies and multiplies it by the value of total business inventory. The value for “other” is calculated as a proportion of the overall inventory carrying cost. This proportion is smaller than the other two subsegments and is based on consensus estimates from various sources.

Other costs

We use the same definitions as last year.

Carriers’ support activities reflect a broad range of services that support shipping. Examples include freight transportation arrangement (freight forwarders and brokers), customs services, packing or crating, port handling, and other freight yard management, container leasing, navigation services, and a number of other related activities. In the case of freight transportation arrangement (forwarders and brokers), purchased transportation has been estimated and removed to eliminate duplicate counting of freight.

Shippers’ administrative costs are built on two specific cost areas: labor and logistics IT. Labor costs are calculated using a weighted average of mean annual wages for manufacturing, retail, and wholesale industries for logistics-related occupations plus the estimated value of total benefits paid to employees in addition to wages. Logistics IT spend is based on industry reports of the supply chain management software market for the United States.

Historical comparisons

To facilitate comparisons with the historical series, the USBLC table has been recalculated back to 2010 using current sources and methodologies (see figure B on page 68). In some cases, government data has been revised or updated, so some figures such as GDP and inventory may differ from previous reports.

Figure B
Ten-year summary of USBLC

Metric	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Nominal GDP	\$ billion	14,992.1	15,542.6	16,197.0	16,784.9	17,521.7	18,219.3	18,707.2	19,519.4	20,580.2	21,427.1
Total business inventory	\$ billion	2,015.8	2,247.4	2,337.9	2,395.4	2,524.4	2,513.8	2,527.6	2,635.9	2,761.0	2,838.6
Inventory carrying rate	%	16.9	16.3	16.4	16.6	15.0	15.8	15.4	15.5	17.3	16.0
Transportation costs	\$ billion	681.9	749.3	785.8	809.9	903.4	907.0	905.7	946.0	1,033.3	1,059.1
Inventory carrying costs (ICC)	\$ billion	340.2	366.0	382.7	398.8	377.5	397.3	388.3	408.4	476.5	454.6
Other costs	\$ billion	69.8	74.4	79.3	82.2	89.4	94.7	93.8	105.3	110.5	116.1
Total USBLC	\$ billion	1,091.9	1,189.7	1,247.8	1,290.9	1,370.4	1,399.0	1,387.9	1,459.7	1,620.3	1,629.8
Total USBLC as % of nominal GDP	%	7.3	7.7	7.7	7.7	7.8	7.7	7.4	7.5	7.9	7.6
Total business inventory as % of nominal GDP	%	13.4	14.5	14.4	14.3	14.4	13.8	13.5	13.5	13.4	13.2
Transportation as % of nominal GDP	%	4.5	4.8	4.9	4.8	5.2	5.0	4.8	4.8	5.0	4.9
ICC as % of nominal GDP	%	2.3	2.4	2.4	2.4	2.2	2.2	2.1	2.1	2.3	2.1
Total business inventory as % of nominal GDP (2011=100)	base 100	93.0	100.0	99.8	98.7	99.6	95.4	93.4	93.4	92.8	91.6
Transportation as % of nominal GDP (2011 = 100)	base 100	94.3	100.0	100.6	100.1	107.0	103.3	100.4	100.5	104.1	102.5
ICC as % of nominal GDP (2011 = 100)	base 100	96.4	100.0	100.3	100.9	91.5	92.6	88.1	88.8	98.3	90.1
Total USBLC as % of nominal GDP (2011 = 100)	base 100	95.2	100.0	100.6	100.5	102.2	100.3	96.9	97.7	102.9	99.4

Source: Kearney analysis

About CSCMP

Since 1963, the Council of Supply Chain Management Professionals (CSCMP) has been the leading world-wide professional association dedicated to education, research, and the advancement of the supply chain management profession. With more than 9,000 members globally, representing business, government, and academia from 62 countries, CSCMP members are the leading practitioners and authorities in the fields of logistics and supply chain management. To learn more, visit www.cscmp.org.

About Penske Logistics

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