

CSCMP'S ANNUAL
STATE OF LOGISTICS REPORT

AUTHORED BY **ATKearney**

PRESENTED BY



Rental | Leasing | Logistics

Cresting the Hill



Table of Contents

- Introduction 1**
- Executive Summary 2**
 - The steep grade starts to crest in 20182**
 - Every sector has a good year2**
 - 2019 and beyond: an opportunity to break the cycle 4**
- Macroeconomics:**
 - The Growth Tide Begins to Recede..... 6**
- The Logistics Industry in 2018 13**
 - Motor carriers: tight capacity, high rates.....13**
 - Parcel: last mile—chasing trained expectations friend or foe?.....17**
 - Rail: on track—for now 23**
 - Water and ports: trade winds and breaking waves 25**
 - Air freight: soaring on e-commerce..... 30**
 - Pipeline: capacity slowly catches up..... 33**
 - Freight forwarding: value of relationships 37**
 - Third-party logistics: solving challenges..... 39**
 - Warehousing: go big and go small 42**
 - Blockchain: waiting for a leap of faith 46**
 - 5G: setting the standard for logistics..... 49**
- Logistics Trends and Outlook:**
 - Sustenance Requires Innovation54**
 - Outlook for the industry..... 56**
- Appendix 61**
 - Estimating USBLC61**
 - Historical comparisons 63**

Introduction

Welcome to the 30th Annual Council of Supply Chain Management Professionals (CSCMP) State of Logistics Report. This year's report identifies an industry at a new crossroads after toughing out the steep grade of last year's constrained capacity and rising prices. This year demand has softened and growth is in doubt, but not to the point where a steep decline is visible, a context we summarize as Cresting the Hill.

Amid a booming economy, United States Business Logistics Costs (USBLC) rose 11.4 percent to reach \$1.64 trillion, or 8.0 percent of 2018's \$20.5 trillion GDP. Growing demand led to a strong job market and rising wages, which carriers and warehouses passed on to shippers as higher prices. Shipping activity was especially intense in Q4, as companies prepared for heightened US-China trade tensions and US business inventory reached an all-time high of \$2.75 trillion, driving increased inventory carrying costs to eclipse increases in transportation costs.

The growth of e-commerce—in both volume and scope—helped fuel modes such as motor carrier, intermodal, third-party logistics (3PL), air freight, and freight forwarding as the rest of retail sought to rise to the occasion. Supply could not keep up with booming demand. Responses varied by situation and strategy, but included shipper of choice programs, increasing captive fleets, forward-deploying to warehouses, and crafting longer-term agreements.

At the midpoint of 2019, many experts expect the economy's momentum to slow, due to the potential for trade tensions to accelerate, global economies to deteriorate, or climate-related risks to materialize. On the other hand, trends such as e-commerce growth, lower fuel prices, and technology-driven efficiency gains could bode well for logistics. Historically, slowing growth and rising capacity have caused shippers to aggressively seek lower rates, causing suppliers to respond by slashing costs and investments—a boom-bust cycle beginning anew. The authors, sponsors, and interviewees in this report have cause for optimism because at the crest of this hill, neither shippers nor suppliers seem satisfied with business as usual and the opportunity to leverage technology and collaborative practices is driving tangible efficiencies and shared gains.

Logistics is certainly on the cusp of technological change. New solutions could transform nearly every sector, from driverless trucks to automated warehouses to blockchain-enabled collaboration, although some of these developments are years away.

In this 30th edition we provide a narrative on macroeconomic 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. In addition to blockchain, we added a special section on 5G, a key building block for many coming technologies. Slight changes to the method of calculating USBLC—co-developed by A.T. Kearney, CSCMP, and a diverse set of industry partners—are explained in the Appendix.

Once again, A.T. 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; Ravi Shanker, Morgan Stanley; Brent Hutto, Truckstop.com; Derek Leathers, Werner; Bob Biesterfeld, C.H. Robinson; and a special thanks to IHSmarkit for their ongoing contribution to the report. 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 2019 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.

Executive Summary

The steep grade starts to crest in 2018

The strong seller's market that carried over from 2017 well into 2018 began to weaken in the second half of the year as capacity started to catch up with demand and the quarter-on-quarter pace of GDP growth began to slow. Partially thanks to trade and tariff disputes that drove US inventory buildups in the second half of 2018, and despite dramatically rising costs for drivers and warehousing staff, logistics providers managed to complete the year with generally excellent results and cautious optimism for 2019. Conversely, shippers hoped for redress after what for most was the worst year in memory in terms of cost and capacity availability. At the halfway point in 2019, signs of slowdown and talk of recession are abundant but in-year rate cuts and other forms of economic stimulus may be on the way.

United States Business Logistics Costs (USBLC) rose 11.4 percent last year to reach 8.0 percent of GDP, a jump of 50 basis points over 2017 (see figures 1 and 2). Key indicators suggest that the economic momentum that lifted GDP 2.9 percent last year will wane with swollen retail and wholesale inventories being depleted and corporations turning cautious in the short term, while the IMF predicts lower US growth in the coming years. Although developments in the second half of 2018 brought some relief to the capacity shortages and price increases, by the end of Q1 2019, consumer confidence and spending had rebounded from end-of-2018 declines, and quarterly GDP growth turned in a robust 3.1 percent growth rate. That's why we name this year's report *Cresting the Hill*.

For company leaders, the temptation to see the shoe as being on the other foot and claw back the 2018 rate increases is powerful (and in some cases baked into 2019 logistics budgets). Cautious carriers have been making concessions and have cut back on capacity plans. At the crest of this hill, we see both hope and evidence of a better road being taken. Leading shippers looking to control logistics costs have leaned more in the direction of constructive engagement and innovation than ever before, and carriers have been pleased with the new collaboration while themselves opening up to start-ups and new technologies for novel solutions to transportation challenges. You will see that evidence in these pages; we hope you will share your own experiences with the authors.

A closer look at 2018 numbers shows rising costs across all USBLC components: transportation, inventory-carrying costs and other expenses. Inventory led the way with a 14.8 percent overall cost increase on a 4.6 percent rise in year-over-year inventories as trade-tension buildups met declining demand. While transportation costs fared better with a 10.4 percent increase, certain modes saw big jumps. For example, Intermodal and private fleets jumped 28.7 percent and 13.1 percent, respectively, as shippers sought alternatives to common carriers and the Postal Service powered up 9.7 percent as the big volume winner in last mile.

Every sector has a good year

Despite the warning signs in the second half of 2017, shippers were caught by surprise by the severity of the spot market freight rate jumps in the first half of 2018 while carriers saw significant spot rate drops in the latter half of the year. Since contract rates lag spot rates by three to six months, shippers with longer term contracted rates suffered less in 2018 but brokers that had extended contracted rates found themselves upside-down on many contracts, struggling to renegotiate them as the owner-operators and smaller fleets they depended on demanded

Figure 1

US business logistics costs increased in 2018**US business logistics costs**

(\$ billion)

	2018	YoY 18/17	5-yr. CAGR
Transportation costs			
Full truckload	296.1	7.6%	3.6%
Less-than-truckload	71.8	8.3%	3.5%
Private or dedicated	300.9	13.1%	7.1%
Motor carriers	668.8	10.1%	5.1%
Parcel	104.9	8.7%	8.0%
Carload	61.4	7.2%	-0.6%
Intermodal	27.0	28.7%	8.1%
Rail	88.4	12.9%	1.6%
Air freight (includes domestic, import, export, cargo, and express)	76.5	9.2%	3.8%
Water and ports (includes domestic, import, and export)	45.7	12.8%	1.5%
Pipeline	53.0	12.7%	12.7%
Subtotal	1,037.4	10.4%	5.1%
Inventory carrying costs			
Storage	153.1	3.2%	3.0%
Financial cost (WACC x total business inventory)	192.5	26.0%	3.0%
Other (obsolescence, shrinkage, insurance, handling, others)	148.1	14.8%	3.0%
Subtotal	493.7	14.8%	3.0%
Other costs			
Carriers' support activities	52.3	10.3%	4.5%
Shippers' administrative costs	52.1	2.8%	5.3%
Subtotal	104.4	6.4%	4.9%
Total US business logistics costs	1,635.46	11.4%	4.4%

Note: YoY is year-on-year. WACC is weighted average cost of capital.

Source: CSCMP's 30th Annual State of Logistics Report (see report Appendix)

fatter payments. Railroads did particularly well on intermodal as shippers sought alternatives to trucks; rail productivity continued to improve as the Class 1 railroads that adopted “precision railroading” principles achieved ever-lower operating ratios.

In the parcel/last-mile space, Amazon continued to raise and train expectations to counteract brick-and-mortar advantages for compressed delivery windows, generating significant excitement for some and challenges for many. Not a day goes by without news about a counter-move, a tech-enabled innovation, or an enhanced standard to serve customers. In many aspects, traditional carriers responding to Amazon's steady growth as a logistics provider are re-thinking relationships. For now, players have not become overly aggressive, because double-digit volume growth in e-commerce and an urgent need for solutions have helped make ends meet for most companies. Before the infrastructure to support last-mile economics is fully in place, however, pioneers will need to shed the mindset of per-shipment-based freight cost recovery, and instead utilize item baskets and membership models. While the industry embraces challenges, we have entered an era of collaboration, flexible alliances, and innovation, and the discernable winner at this point is the consumer.

Air freight prices increased 9.2 percent in 2018, even as capacity grew faster than demand. Volumes stagnated at the end of the year, and demand growth is expected to slow in 2019. On the other hand, e-commerce—and consumer demands for quick delivery—continues to fuel a positive outlook.

Water carriers took advantage of high pre-tariff demand to implement pricing discipline, resulting in record-high ocean shipping rates. Although the 2019 demand was expected to ease, initial reports on contract negotiations nevertheless indicated double-digit gains for carriers. Uncertainty surrounding the IMO 2020 sulfur regulations, which will be implemented on January 1, 2020, cloud the longer-term picture.

In the pipeline sector, recent investments have helped pipeline capacity catch up to surging oil and gas production. Gas from the Marcellus shale formation increasingly fuels electricity generation, and export demand increases for oil from the Permian Basin.

Freight forwarders remain profitable, thanks to a focus on customer service amid continually rising levels of trade. In 2018, DSV acquired Panalpina, and CMA CGM acquired CEVA, but further consolidation seems likely in the fragmented industry. Potentially disruptive forces include the start-up Flexport, the transformation of Amazon, and growing climate concerns among customers.

In 3PL, cost pressures and last-mile challenges are creating increasing demand for solutions and elevating some providers to a more strategic role. Emerging technological solutions will surely play a role in the sector's future path—but so will an ability to nurture trusted relationships with customers.

US industrial warehouse/distribution net absorption rose 16.8 percent over the previous year to an all-time high of 284.9 million square feet (msf) in 2018. It has now registered over 240 msf for five consecutive years—the strongest run on record. The national industrial vacancy rate declined slightly to 4.8 percent for all product types in 2018—a new historic low—with market conditions tightening slightly in the Northeast, Midwest, and South. Average asking rents for all industrial products across the US reached a new nominal high of \$6.14 per square foot (psf). In short, despite increases in supply, voracious demand and limited space options caused record-low vacancy rates and fueled rent growth. E-commerce is creating demand for smaller, urban warehouses, as shippers try to keep inventories close to customers for fast delivery. The increasing demand for speedy deliveries, combined with tight space and high labor costs, is prompting investments in new technologies.

In early development, blockchain technologies continue to offer hope for improving data transparency and data sharing—thus overcoming some of the greatest inefficiencies in logistics today. Although varied players are developing intriguing potential solutions, achieving blockchain's benefits will require scale; thus, achieving widespread participation remains an obstacle.

This year's report adds a section on the 5G mobile broadband and communication standard, which promises to transform the industry. In the short term, it will help create an information-rich environment that will improve operational efficiency. In the long term, its support for solutions such as robotic picking-and-packing and AI-based planning will fundamentally change how business is done.

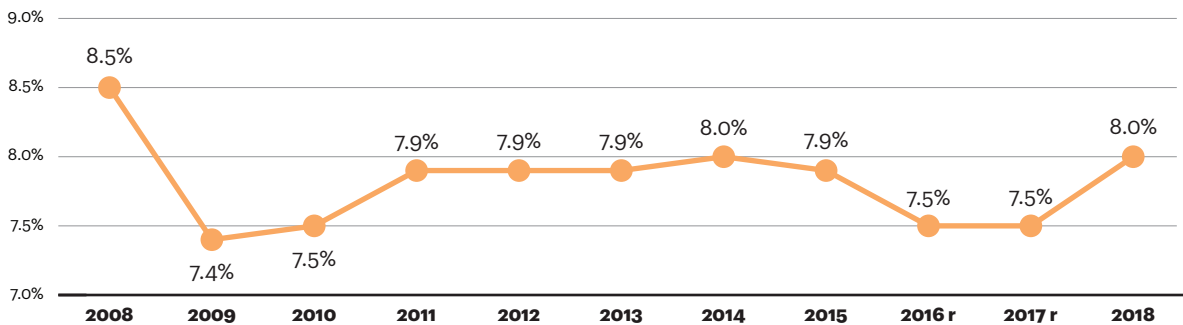
2019 and beyond: an opportunity to break the cycle

We are striking an optimistic tone with this year's theme: Cresting the Hill. With the current mixed economic and trade outlook, there is evidence for almost any perspective:

- The current expansion has now reached a record as the longest-running period of consecutive economic growth in US history

Figure 2

USBLC as percent of nominal GDP



Note: r means revised; see Appendix for details

Source: A.T. Kearney analysis

- In that same history, every expansion has been followed by a contraction, and the longer the growth, the longer the period of pain; it's easy to find economists forecasting recession
- The current administration is publicly determined to sustain growth, and the Federal Reserve has reversed course over the last six months from a language of rate increases to hinting the opposite may be in store

While shippers and carriers can neither predict the direction of the next move in the economy nor its timing or intensity, they know that they each bear responsibility for some of the pain of the past and that remedies are available to them. This report explores some of those remedies that are being adopted today, which include:

- Implementing shipper of choice programs to improve the carrier experience and the efficient deployment of their assets
- Investing in position-sensing technologies that enable more effective allocation and utilization of assets by logistics operators and the software that supports them
- AI and machine-learning algorithms that make brokerages more efficient at serving their customers and matching drivers to loads
- Advancing collaborative optimization techniques in logistics sourcing and network design that fully leverage the power of early carrier and 3PL consultation
- Collaborative contracts between shippers and carriers seeking to increase the sustainability and utilization of the assets in use
- Shared economy concepts and applications that make better use of last-mile drivers and contract logistics spaces

As we predicted over the last two years, uncertainty became a steep grade. Carriers and shippers faced a choice: to either slog through it with conventional tactics or engage with opportunities to do something different, something better. More and more are trying the latter approach and are reaping the rewards. As this latest hill is crested and the players in the industry can see forward to how the next ones will test them, the rewards will go to those that seek bold new solutions.

Macroeconomics: The Growth Tide Begins to Recede

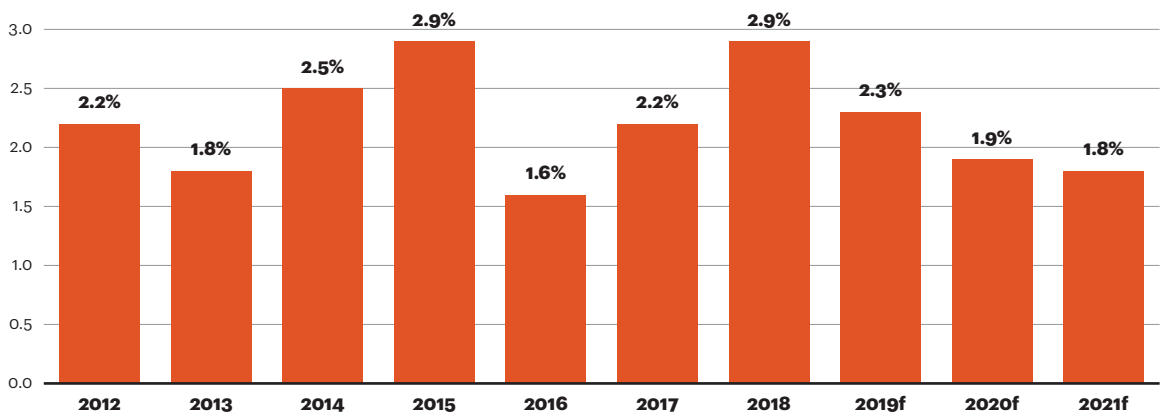
The US economic outlook is softer than it was last year, when the report theme was “Steep Grade Ahead.” We argued that the logistics industry would struggle to keep up with rapid economic growth and, indeed, 2018 tied with 2015 for the fastest-growing year in the decade since the financial crisis with 2.9 percent GDP growth. For shippers, conditions proved even more stressful than expected as capacity—especially in road, rail, and warehousing—did not keep up with demand. Trade tensions then exacerbated inventory buildups around the holiday-season crunch. The results were service declines and steep rises in prices for shippers and a strong outlook for carriers.

This year, with our theme Cresting the Hill, there’s a shift in gears. The economy’s momentum is carrying forward in the first half of 2019, including with stronger-than-expected first quarter growth, but global economic growth is expected to slow in the final two quarters of the year. Although US growth will likely be stronger than most other developed markets, it too will slacken. According to the IMF, US GDP growth will slow to 2.3 percent in 2019 and then 1.9 percent in 2020 (see figure 3). Combined with the unwinding of inventory buildups resulting from a pre-tariff import boom and growing fears of a US recession that may weigh further on the outlook, the result will be lower demand for logistics services. This is good news for shippers, but carriers will struggle as volumes fall.

Figure 3
US economic growth is forecast to slow

US real GDP growth

(Annual percent change)



Sources: International Monetary Fund; A.T. Kearney analysis

Although slowing growth bodes poorly for businesses across sectors, a slower 2019 brings relief to logistics industry capacity shortages, easing the price increases that bedeviled shippers. In particular, the air freight and ocean shipping sectors are unlikely to match the intense activity of late 2018, when high growth rates coincided with elevated imports in anticipation of escalating US-China trade tension. So long as tariffs against agriculture and other goods remain in place, exports will continue to remain depressed as well. There are no indications that the reciprocal

tariffs already imposed by the United States and China will be easily lifted, as disapproval of Chinese trade practices is an area of bipartisan agreement. The IMF predicts that US-China trade tensions will reduce global GDP by 0.2–0.4 percent over the medium term, while US GDP losses will range between 0.3 and 0.6 percent.

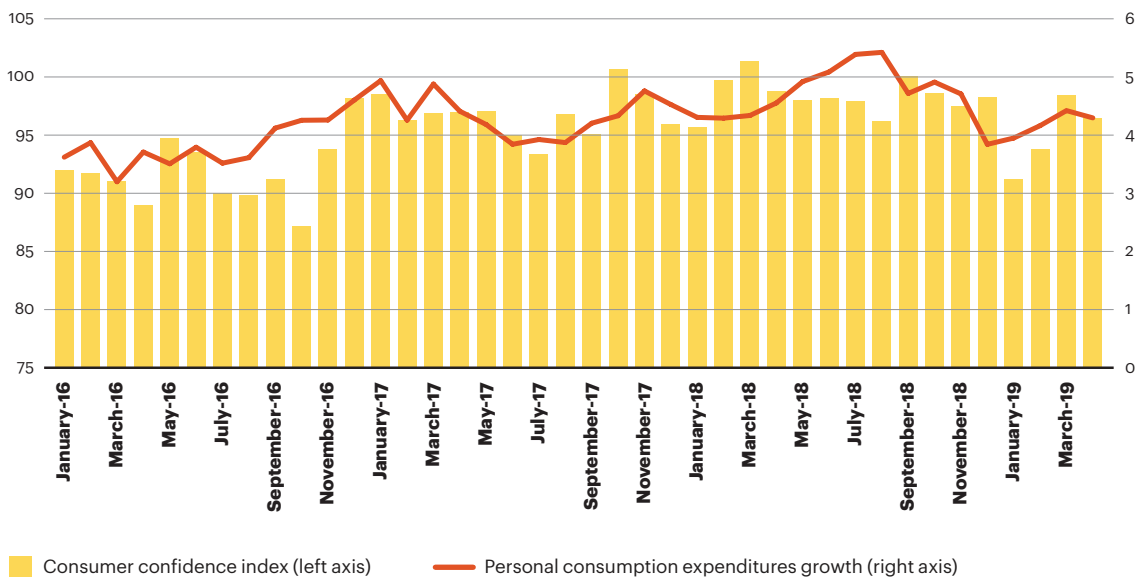
Economy flashing warning signs

Several factors contribute to mixed US economic growth expectations. The consumer confidence index registered a marked reduction in sentiment in the second half of 2018, with consumer spending falling in kind. Both rebounded over the first quarter of 2019, however, as short-term optimism returned (see figure 4). Retail sales data points to a continuing slowdown, however. But with so much American wealth tied up in the housing market, slowdowns in existing home sales and weakening housing starts may also drag down consumer confidence going forward. Meanwhile, e-commerce sales continue rising year-on-year, taking a greater share of the retail sector and providing an important source of growth for the logistics industry. This is especially true for the forward-deployment of inventory and last-mile delivery, which are innovating to meet growing consumer demand for ever-faster service.

Figure 4
Consumer confidence and spending rebounded in the first quarter

US consumer confidence and personal consumption expenditures growth

Index values (year-over-year percent change)



Sources: University of Michigan, US Federal Reserve; A.T. Kearney analysis

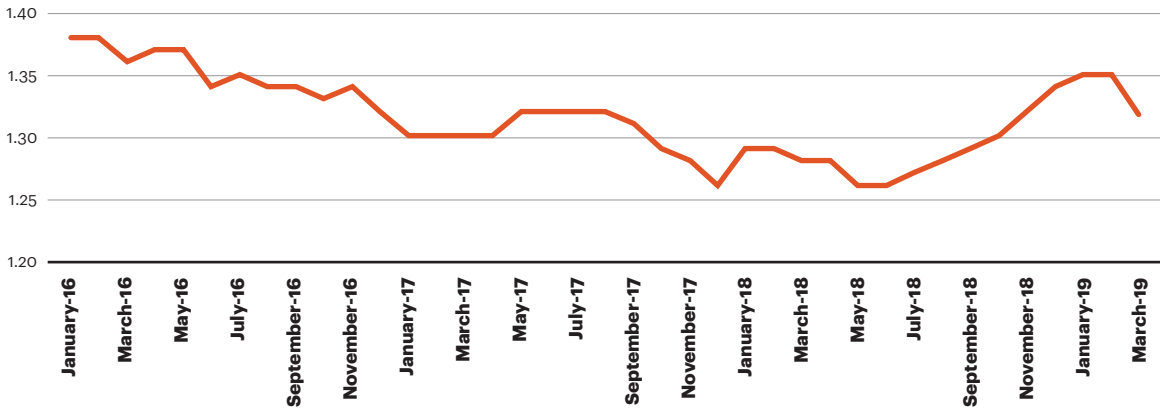
The business investment climate is more neutral, although warning signs are flashing there, too. The inventory-to-sales ratio, often used as an indicator of business confidence in future sales, has been steadily declining since 2016, and is in fact part of a larger trend which dates back to the mid-1990s, resulting in large part from increased supply chain efficiency. Bucking the trend, in late 2018, inventories rose dramatically as importers stockpiled in preparation for 2019 tariffs, and then afterward encountered a weakening sales environment (see figure 5 on page 8).

Figure 5

Wholesalers have been stocking up inventory in recent months

US merchant wholesalers

Inventories to sales ratio (seasonally adjusted)



Sources: US Federal Reserve; A.T. Kearney analysis

In terms of US fiscal policy, lawmakers, economists, and workers all hoped that US tax reform—which resulted in a significant tax cut for businesses—would boost business investment and further drive growth. But a recent survey of supply chain professionals reported an overwhelmingly neutral or ambiguous impact of the tax reform to date. Companies in the logistics industry and across the economy largely used tax savings to fund share buybacks rather than investments.

Although refiners and ocean shippers have had more than a decade to prepare for clean fuel regulations, fuel market disruptions are anticipated when they come into force on January 1, 2020.

Fuel prices may provide some relief. Average fuel prices will be lower in 2019, according to the US Energy Information Administration (EIA), but will likely spike toward the end of the year, as the implementation of clean fuel regulations for the ocean shipping industry comes into force on January 1, 2020 requiring a shift in the fuel mix for the ocean freight that will impact the fuels market more broadly. These regulations require ships to either install scrubbers or switch to low-sulfur diesel fuel to reduce emissions. Although refiners and ocean shippers have had more than a decade to prepare for the regulations, fuel market disruptions are anticipated—and forecasts for the cost impact for 40-foot equivalent unit (FEU) bunker charges range from \$150 to \$300, depending on the routes.

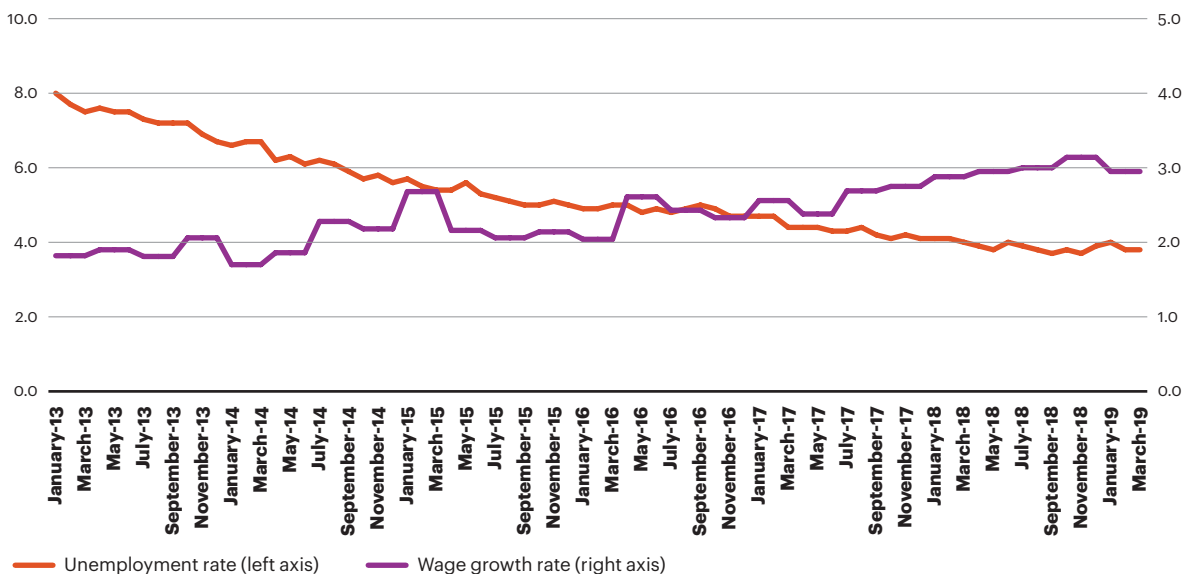
A very tight labor market constrains industry

The labor market is particularly tight as unemployment falls to historic lows and wage growth accelerates. January 2019 was the 100th straight month of increased employment while new unemployment claims fell to a 49-year low in April—a pattern that is contributing to wage growth (see figure 6). A new analysis by the Federal Reserve Bank of Dallas also suggests that standard statistical calculations actually understate how much wages are increasing. Many sectors of the logistics industry, especially trucking and warehousing, feel this directly, with reported rising labor costs and difficulties finding and retaining qualified workers.

Figure 6
The US labor market continues to tighten

US labor market

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



Sources: US Bureau of Labor Statistics, US Federal Reserve; A.T. Kearney analysis

Labor remains a particular challenge for trucking companies. Reports of a trucker shortage persisted for so long that it led the US Bureau of Labor Statistics to explore if there were additional factors at play beyond traditional supply and demand dynamics. While the study concluded that the market for truck drivers is indeed tight—particularly between 2003 and 2017—the overall market for truck drivers responds appropriately to price signals and, over time, will balance. Until this occurs, driver shortages, particularly in long-haul trucking, will continue to challenge the industry, requiring pay increases to stymie the rise in driver turnover.

While most of today's data indicators put labor in a strong position, the specter of automation looms. For example, in March 2019, members of the International Longshore and Warehouse Union protested A.P. Moller-Maersk's plans to replace diesel trucks with unmanned electric vehicles at the port of Los Angeles. The coming rollout of 5G telecommunications networks is expected to boost the development and deployment of automated vehicles, including trucks, which will reduce industry costs at the expense of workers. Leading service providers state that workers will be able to move up the value chain by doing more content-rich and customer-facing

work, creating a leaner, higher-skilled workforce. From a labor perspective, this transition—while certainly not unique to logistics—will be painful, and companies will likely be expected to invest in worker retraining and up-skilling efforts.

Cautious monetary policy

Weak economic growth signals combined with tepid inflation have caused the US Federal Reserve to pause raising the interest rate, with either a steady hold or a rate cut being the two most likely scenarios through the remainder of 2019. This is a significant shift in expectations after the Fed raised interest rates four times in 2018 and, at that time, signaled its willingness to move rates higher into 2019.

This action in the face of growing global economic headwinds puts the US Federal Reserve back in line with the monetary policies of other major developed economies. For example, the European Central Bank has delayed interest rate hikes, while the Bank of England is holding rates steady given Brexit uncertainty. Australia's central bank is similarly expected to either hold or cut rates over the next several quarters.

Trade tensions have significantly impacted the logistics industry, as companies must prepare for uncertain volumes and comply with shifting regulations. Separately, Chinese domestic policy is further roiling the ocean freight sector.

Although the move confirms an economy coming under pressure, it also extends the period of low capital costs for companies and provides an important measure of predictability in the coming quarters. As a result, the window during which companies can make important capital improvements and strategic investments at relatively low cost is extended—although some economists argue that further prolonging low interest rates in a tight labor market raises the risk of inflation.

Political risks loom large

Although the US policy environment remains subject to swift changes, particularly for international trade, a divided government through at least 2020—with Republicans holding the White House and Senate, but Democrats holding the House—means that no major policy initiative affecting the logistics sector or the broader economy will likely become law.

On trade, the biggest issue among many is the ongoing US-China trade tension, which shows no signs of resolution. On other fronts, potential automobile tariffs are creating tensions with Europe, Japan, and other auto exporters. Although the US-Mexico-Canada Agreement (USMCA) promises increased certainty within the North American trade environment, an ongoing and contentious ratification process makes it not yet certain.

Each of these issues has significantly impacted the logistics industry, as companies must prepare for uncertain volumes and comply with shifting regulations. Separately, Chinese domestic policy is further roiling the ocean freight sector, as its sweeping shift in its recycling policy—which has brought its imports down to nearly zero—is leaving massive volumes of recycling materials stranded in ports and across major economies, including the United States.

Domestically, the dream of a bipartisan infrastructure bill lives on. Industry still advocates for it, and both parties continue to point to it as an area of potential compromise. Like any major initiative facing divided government, however, its prospects for becoming law before the 2020 US presidential election are low. This is unfortunate, as the absence of a major infrastructure investment initiative will be a drag on the logistics industry. Indeed, little has changed since the 2017 Infrastructure Report Card of the American Society of Civil Engineers gave the country's roads and aviation infrastructures D grades, and its ports and bridges C+'s, despite previous expressions of bipartisan interest in a rebuilding effort.

New regulations that would constrain the fast-moving e-commerce sector present another policy risk. In the spring of 2018, the Trump administration formed a task force to examine the business model of the US Postal Service (USPS), which has been struggling financially. The final report recommended a major overhaul of the USPS, including a shift in the pricing model for packages that would have major implications for the big e-commerce players. No new regulations have been announced yet, but the moves that some e-commerce leaders are making to develop their own logistics infrastructure would reduce their regulatory exposure in either scenario.

Accounting for climate change

Climate change-related natural disasters are posing increasing risks to economic growth. Recent major hurricanes, wildfires, and other natural disasters have been more intense than before. In addition to their impacts on specific geographical regions, a 2018 paper from the Richmond Federal Reserve suggested that higher summer temperatures alone could dampen productivity and thus impede growth. Investors are increasingly aware of climate change risks—and pressuring businesses to disclose them. For example, BlackRock, the world's largest asset manager, in April 2019 released a study arguing that markets have consistently underpriced physical climate risks and encouraging investors to consider how companies plan to mitigate those risks.

Climate risks are particularly high for the logistics industry. For example, as capital-intensive facilities with a long expected lifetime, ports are having to adapt to rising sea levels, often at great cost. Major hurricanes pose significant risk to ports and other coastal assets. For example, during Hurricane Harvey, in 2017, approximately 16 percent of US oil refining capacity was closed, while other refineries ran at sharply reduced capacity. In addition to the localized damage, fuel prices rose across the country and trucking capacity was claimed by emergency services.

The risks are not confined to the coasts. The March 2019 Midwestern floods created significant disruptions and suspended service on Union Pacific and BNSF rail networks. The flooding, caused by wetter weather and rapid spring warm-up, was so widespread that rerouting capabilities were limited. Similarly, forest fires pose hazards to fixed assets—and employees—in their path. Beyond the dangers of being caught in the fires themselves, smoke and other health hazards close roads, delay flights, and shut down warehouses. For example, the Camp Fire—the largest of the three California wildfires in late 2018—occurred in a region that had recently undergone a construction boom for logistics and warehousing infrastructure to support the fast-growing e-commerce industry.

All logistics players must therefore anticipate more extreme weather-related disruptions in 2019 and beyond. The measures to consider are purchasing both flood and business interruption insurance, spreading inventories across a network of warehouses in case one becomes unavailable, preparing agreements with temporary storage providers or cross-dock facilities, identifying backup suppliers and backup production facilities, and planning ahead for added costs.

Taken together, these macroeconomic factors may seem like a gathering storm intent on punishing the future state of US logistics—however, silver linings do exist. For example, sustainability efforts intended to reduce carbon emissions are proving to make good business sense. Once relegated to the world of corporate social responsibility (CSR), businesses in the logistics sector and beyond are finding efficiencies and cost savings through sustainability improvements, including through procurement, supply chain, and waste management practices. Consumers and investors are also increasingly rewarding companies that make such investments. McDonald's, for example, is working with its franchisees, suppliers, and producers to meet a 2030 goal of 31 percent emissions reduction across its supply chain. AB InBev is using its procurement processes to support sustainability efforts and drive top-line growth. On the carrier side, XPO Logistics released its first sustainability report in April 2019, in which it laid out energy efficiency objectives for warehouses and a commitment to fuel-efficient truck fleets. These examples underscore the business case for such investments—not only for environmental reasons, but because companies are finding that they can be both more efficient and maintain or grow their customer base with a commitment to sustainability.

The Logistics Industry in 2018

Motor carriers: tight capacity, high rates

Year in review

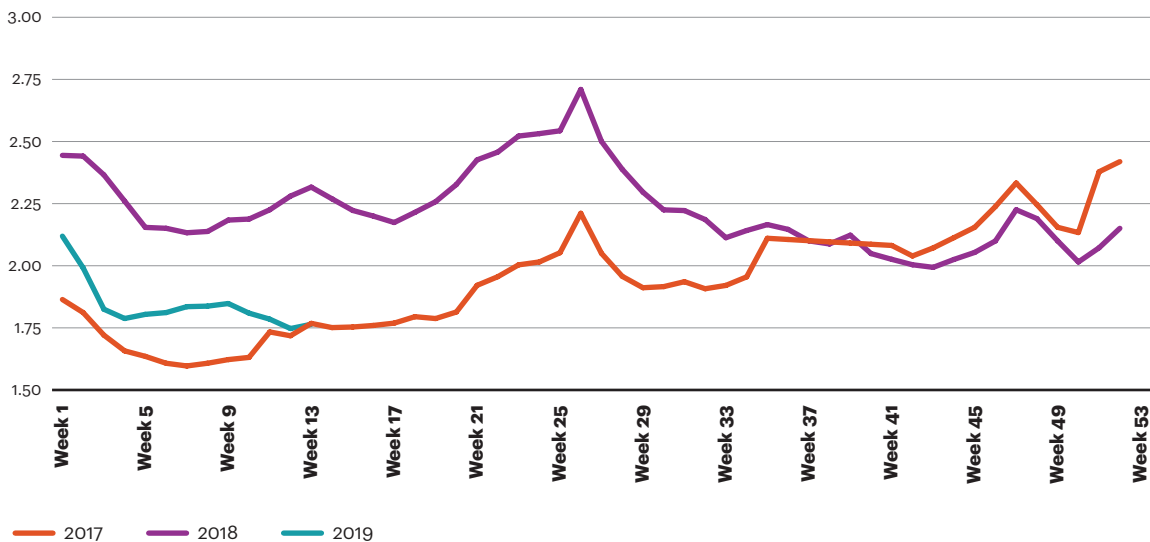
2018 was a challenging year for shippers—capacity tightened and rates rose. According to Truckstop.com data, spot market freight rates increased approximately 25 percent from the post-holiday seasonal trough in February to the summer peak, then fell approximately 20 percent through the end of the year (see figure 7). This caused shippers across virtually all industries to exceed their 2018 logistics budgets. The impact was so significant that shippers noted in SEC filings, interviews, and analyst calls that freight had a material negative impact on earnings. Large shippers publicly commenting on freight rates included Caterpillar, Kraft Heinz, General Mills, Hershey, Whirlpool, and Coca-Cola.

Figure 7
Freight rates increased from 2017 to 2018

Dry van spot rates

(2017–2019)

Weekly spot rate (\$)

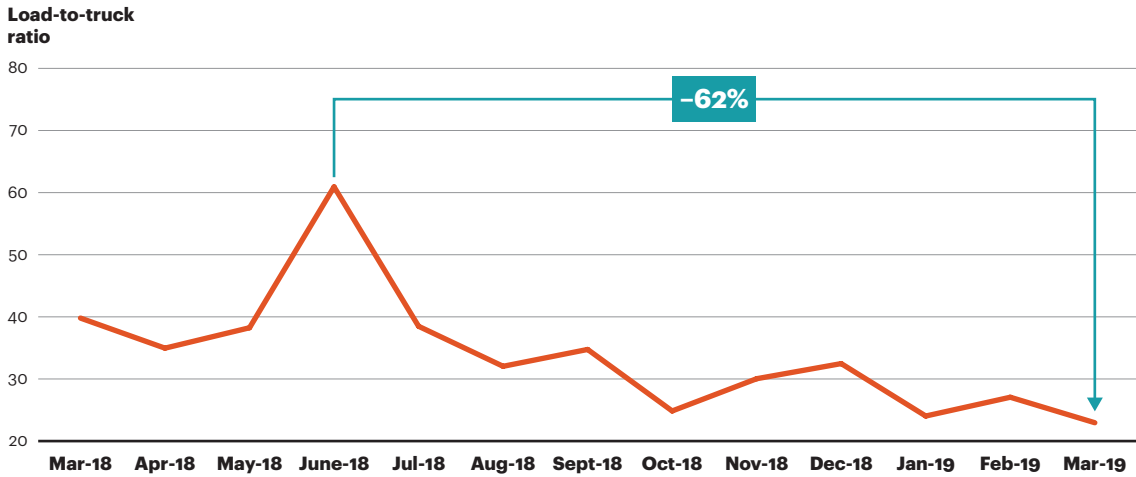


Sources: Truckstop.com; A.T. Kearney analysis

While the common narrative is that rates were driven by tighter government regulations (for example, electronic logs) and rising driver wages, this tells only part of the story. Economic activity in 2017 and 2018 led to excess demand for transportation as shippers rebuilt inventories in addition to adapting to growth in e-commerce and to strong consumer demand. This resulted in unbalanced capacity (supply) and demand (requested loads) (see figures 8 and 9 on page 14). As a result, carriers took the opportunity to increase margins through higher rates.

Figure 8
The load-to-truck ratio peaked in June 2018

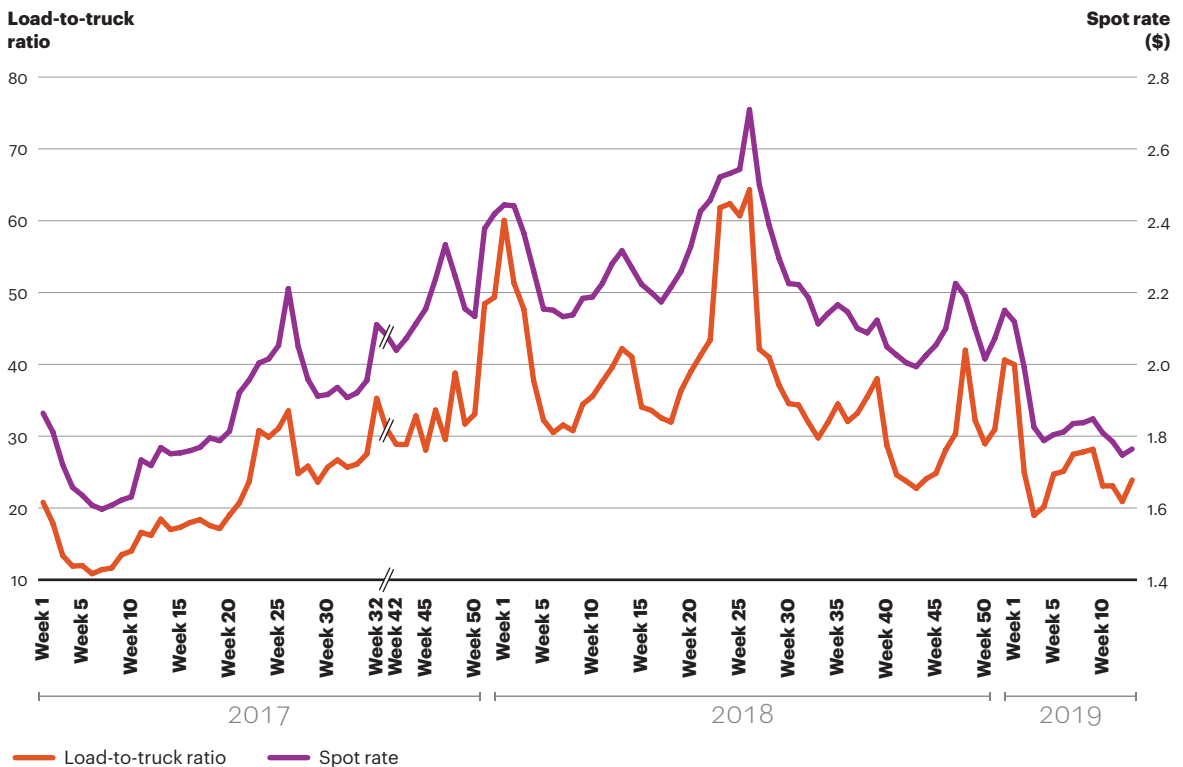
Dry van load-to-truck ratio
 (2018-2019)



Note: The load-to-truck ratio represents the ratio of demand to move freight and the capacity available in the marketplace.
 Sources: Truckstop.com; A.T. Kearney analysis

Figure 9
Rates increased as a response to tightened capacity

Dry van demand vs. spot rates
 (2017-2019)



Sources: Truckstop.com; A.T. Kearney analysis

The carriers' perspective

Carriers enjoyed a higher rate environment in 2018, driving improvements in profitability (as measured by operating ratios) and productivity (as measured by revenue per truck). Carriers were able to capitalize on higher freight rates without sustaining significant increases in driver or fuel costs as a percentage of revenues. They achieved these results despite a generally inflationary driver cost environment (for example, higher signing bonuses and carriers publicly communicating wage increases) (see figure 10). This shows how much carriers were able to exercise market power for price increases in 2018.

Figure 10

Motor carriers' improved revenue and profitability

Truckload segment performance

	Revenue ¹			Operating ratio ²		
	FY18	FY17	%Δ	FY18	FY17	%Δ
Schneider National	\$2,268	\$2,187	3.70%	89.40%	91.00%	-1.80%
Werner Enterprises	\$1,881	\$1,635	15.00%	89.20%	91.50%	-2.50%
Knight-Swift³	\$1,144	\$906	26.20%	81.70%	89.80%	-9.00%
Heartland Express	\$611	\$607	0.66%	85.30%	89.50%	-4.20%
Marten Transport	\$598	\$546	9.50%	91.10%	92.10%	-1.00%

¹ Revenue shown in millions

² Operating ratio is operating costs / operating revenue; lower is more favorable.

³ Reflects legacy Knight Trucking operations only.

Sources: Carrier 10k Filings; A.T. Kearney analysis.

Driver turnover continues to be problematic as drivers increasingly seek an improved quality of life, predictable schedules, and time at home—and they are able to compare trucking to other well-paying jobs such as working at e-commerce fulfillment centers. Driver turnover problems are compounded by a lack of new labor entering the trucking market. Werner Enterprises CEO Derek Leathers attributes this to a generational change in the labor pool. According to Leathers, “Forty years ago, widespread farm consolidation drove rural Americans to enter trucking... It was appealing because of pay and life on the road... Today we don’t have that same labor pool.” To address this issue, carriers are expanding recruiting programs with a focus on new pools of potential drivers, including ex-military personnel. Curiously, technology is making recruiting more difficult, as candidates are more quickly disqualified due to access to detailed background checks.

Given driver challenges and a constant need for gains in asset productivity, carriers are investing in new technology. Specifically, they are looking into in-cab telematics and advanced, predictive analytics technology to support additional efficiency gains. Not only are these technologies automating routine workflows (for example, replacing driver check-in calls with

real-time GPS tracking and geo-fencing), but the latest telematic technologies are also enabling real-time optimization of tractor operation. This allows for improved safety and a reduction in fuel consumption. Additionally, advanced analytics combined with improved upstream integration with shippers is increasing carriers' ability to plan routes and loads. Today, leading carriers can plan driver routes over weekly rather than daily time horizons. This results in better asset utilization, improved predictability for drivers, and higher service levels for shippers. In summary, if it can be planned, it should be planned.

Carriers slowed their spending on large mergers and acquisitions in 2018. Following the Knight-Swift merger announced in 2017 and Schneider National's IPO the same year, fewer large transactions occurred. While US Xpress had a successful IPO, Penske acquired Epes Transport Systems, and several other smaller bolt-on acquisitions occurred (for example, Knight-Swift's acquisition of Abilene Motor Express), companies such as XPO that have historically made splash acquisitions were largely quiet in 2018. Despite the slow-down in acquisitions, smaller carriers are finding it increasingly difficult to compete given rising capital requirements for investment in technology and a general trend toward shippers preferring large, more established carriers.

The shippers' perspective

There is no other way to put it: 2018 was among the most challenging of years for shippers. Tight capacity led to significant, and in some cases multiple, rate increases in order to continue to secure capacity. Shippers struggled to contain spend. In 2018 they were forced to adjust their business models to maintain capacity and better control costs using two common strategies: implementing additional captive (for example, dedicated) fleets to assure service, and becoming *shippers of choice* by improving their operations to make their freight more desirable to carriers.

Although dedicated fleets create advantage for shippers by guaranteeing access to capacity, several network characteristics are necessary in order to justify dedicated fleets: sufficient density to ensure maximum utilization, relatively short lengths of haul to prevent excessive empty miles, and a culture of hands-on logistics management.

Shipper of choice activities are among the most commonly cited approaches to more effectively manage transportation costs and ensure capacity. Shippers of choice tend to be more driver-friendly. They have decent on-site facilities, well-managed in- and out-gate processes, and limited dock dwell. Additionally, their contractual terms and conditions are reasonable and allow for risk management from both carriers and shippers without burdening carriers with unnecessary costs. As technology has improved, specifically access to social media-type rating systems, carriers have begun carefully logging facilities operations. This information is used during bid events to tell the carrier's side of the story and potentially fire undesirable shippers or underperforming locations.

In addition to dedicated fleets and shipper of choice, shippers are also placing more emphasis on understanding *total cost of ownership*. They are evaluating not only contractual freight costs, but also exposure to spot market rates and accessorial charges. Large shippers have noted that they have had success in mitigating irregular operations and out-of-plan shipments by raising base rates, thereby minimizing their exposure to spot rates. This strategy, however, becomes less advantageous as spot rates fall and capacity increases. Regardless of market trends, leading shippers are leveraging data and analytics to improve internal reporting and performance management practices.

Sidebar: Interview Spotlight on C.H. Robinson's Bob Biesterfeld

Bob Biesterfeld, CEO of third-party logistics and multimodal transportation services provider C.H. Robinson, has had many roles at the company over the last 20 years.

A.T. Kearney: What are the biggest disruptors to logistics that you see on the horizon?

BB: We're seeing a massive flow of private equity and capital flowing into TransTech. TransTech actually rivals FinTech in terms of investment. Transportation companies are becoming more tech-savvy—the cost of compute is coming down, and companies are using data more effectively.

It's not just entry of big tech into traditional logistics. Our customers tell us that our people are important to them and their business model, and we are investing in technology to make our people more effective and more efficient.

A.T. Kearney: Through the eyes of shippers, how do you see the role of brokers evolving?

BB: When I joined C.H. Robinson, you would spend the first hour of a meeting trying to convince shippers that broker wasn't a four-letter word. Now, today, the broker is part of shipper strategy. Shippers accept brokers, they understand the role in the marketplace, and there is an expectation from shippers that they will use brokers in multiple ways. Additionally, to broker at scale today you must have good technology; it's a requirement. Our big advantage is we are doing very similar things to the start-ups in terms of predictive technology, communication, etc. but rather than having to buy third-party data, we have billions of dollars of freight data we can use to improve our offerings, and offer an information advantage to provide better outcomes.

A.T. Kearney: What should customers and carriers look for from technology?

BB: In my experience, customers look for several things: real-time analytics (for example, benchmarking), visibility into their

supply chain, placement of inventory for multichannel fulfillment, and lower cost. From a carrier standpoint, they are looking for visibility into asset locations, connectivity to systems (for example, EDI, in-cab ELDs, etc.), early access to freight—carriers ultimately want to route plan to maximize earnings, equipment utilization, etc., and do it in real-time. We are investing to help our employees work more effectively, with consolidated workflows. Ultimately our customers and carriers are looking for a few things—a consultative relationship to help them operate more efficiently, and to make doing business as easy and frictionless as possible.

Parcel: last mile—chasing trained expectations friend or foe?

Last year's report raised the question of who would undertake the financial burden of growing customer expectations—and whether this would prove to be a headwind for e-commerce growth. Earnings reports were impacted by slowing global trade, increased domestic competition, and thinning margins partially due to an increase in business-to-consumer (B2C) deliveries, which now comprise half of the parcel industry. This year we investigate whether chasing trained expectations, pioneered by Amazon, is a road to riches or ruin.

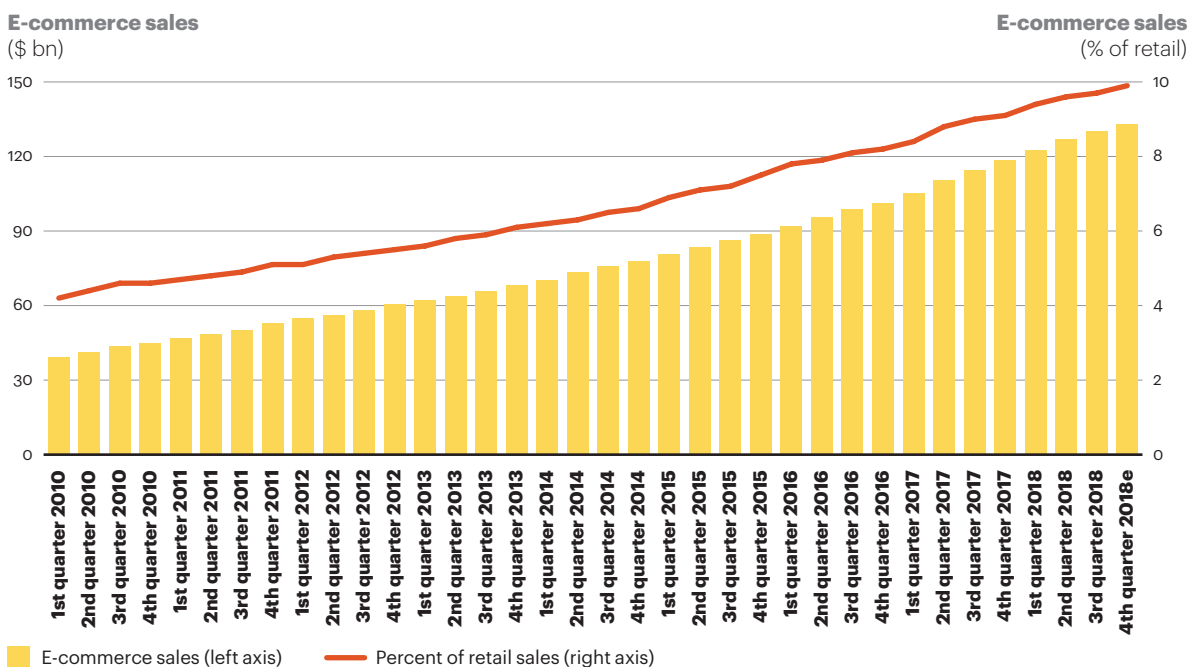
To answer the question, it is important to understand differing requirements across product segments and industries. For example, grocery and medicine are better suited for shorter delivery windows, and apparel, furniture, and personal care could possibly accommodate longer ones. Needs-based segmentation is an essential building block to allocate premium services optimally and prevent a possible Amazon burn-out.

The parcel challenges

Parcel expenditures increased to \$105 billion in 2018. For several years now, e-commerce shipments have fueled consistent growth in parcel delivery—and they are likely to do so for several years to come. E-commerce sales rose 14.2 percent in 2018—impressive compared to 4.8 percent for total retail sales, although e-commerce remains a small percentage of that total. E-commerce sales are expected to grow at a compound annual growth rate (CAGR) of 12 percent for the next five years (see figure 11).

Figure 11

E-commerce sales and e-commerce as a percent of retail



Sources: US Census Bureau Quarterly E-Commerce Report; A.T. Kearney analysis

The four pain points of e-commerce continue to create challenges for parcel carriers:

- **Delivery density.** With more residential deliveries—often single-package stops—routes are longer and less efficient.
- **Variability.** Shipments in the Thanksgiving-to-Christmas window are at about twice non-holiday levels. Volumes also fluctuate across weekdays as a flood of weekend orders are picked up Mondays and delivered Tuesdays and Wednesdays.
- **Volume profiles.** As e-commerce expands to larger and irregularly shaped items (mattresses, patio furniture) that won't fit on standard sorting equipment, special handling is required.
- **Click-to-door requirements.** Same-day, two-hour, rush, critical, urgent—customers have a seemingly insatiable demand for getting their packages as fast as possible.

Beyond expanding facilities and hiring temporary workers, carriers have continued to invest in technology solutions to meet these challenges. Automation will continue to play an integral role while machine learning and artificial intelligence will increasingly contribute to efficiency,

through better forecasting and improved route and network optimization. Crowdsourcing has become an integral part of the last mile, as the only proven cost-effective delivery method for certain products such as groceries. As we observe crowdsourcing and independent contractor platforms flourish daily, we are concerned that they all utilize similar driver pools—what is initially thought of as an infinite cheap and flexible pool could as well succumb to the law of scarcity.

These various challenges create margin pressures for carriers. Price increases in parcel were consistent with previous years at 4.9 percent. Surcharge increases continued to outpace general rate increases this year; some examples include residential surcharges at 6–10 percent and additional handling and large package surcharges at 12.5–19 percent. USPS continued to lose billions, with most of the loss driven by mandated future retiree health benefits—and this continues to attract attention to the Amazon contract. Meanwhile USPS increased rates by 9 to 12 percent.

New competitors

In a regulatory filing in January 2019, Amazon listed “transportation and logistics services” companies as among its competitors. The filing confirmed what many carriers already felt (though few publicly said so): the disruptive behemoth has a new target industry. Shipping with Amazon (SWA) is designed to address longstanding pain points, such as residential surcharges, from shippers of the parcel industry. SWA makes use of Amazon’s state-of-the-art supply chain including its fleet of 50 airplanes with ATSG and Atlas.

The filing confirmed what many carriers already felt (though few publicly said so): the disruptive behemoth has a new target industry.

Amazon Web Services (AWS—an interesting acronym coincidence) began as an in-source cloud-computing project but has expanded to a successful externally facing business. Can Amazon repeat the feat in parcel with SWA? The key is to create scale with sufficient volume and density to sustain asset utilization. Because Amazon has plenty of scale, it has the luxury of cherry-picking parts of its network that can justify “owning assets.” As large as it is, even Amazon needs to utilize third parties for price competitiveness in some parts of its network, although not all parts. Changing relationships with third parties can take a toll on partners, as for example when Amazon slashed its business with XPO in late 2018.

The SWA question really has two parts: First, can Amazon transfer the AWS model to parcel? Second, how would that impact others? We believe that Amazon’s use of in-sourced models will be opportunistic, meaning that Amazon will continue to rely on third parties. Thus, we believe the impact on third-party carriers will be relatively non-disruptive. Even beyond Amazon, the growth of e-commerce continues, so the size of the pie grows.

Amazon Flex, the crowdsourced last-mile solution, is another good example of cherry-picking. Crowdsourcing is no longer a proof of concept, especially for product segments where the value of goods is low, such as groceries. According to Walmart, Spark (its last-mile delivery service) is the most cost-effective delivery method for low-density deliveries and is forecasted

to continue growth. With Flex, Amazon competes in this proven niche. Amazon also continues to experiment in consolidating deliveries, with the newest example being Amazon Day. Target also released its own versions of consolidation options.

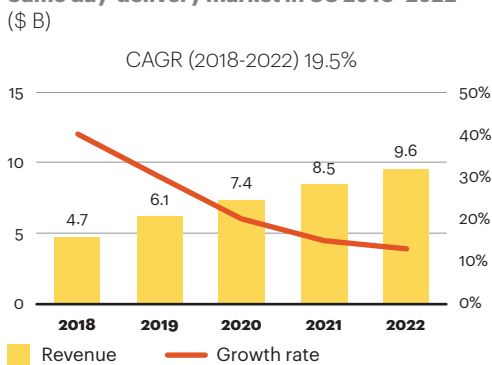
Compressing delivery windows the culprit

Same-day delivery is now approximately a \$5 billion industry; it's the fastest-growing service type for e-commerce deliveries, although the pace of growth will slow. Primarily B2C, it is comprised of three sub-services: regular, priority, and rush (see figure 12).

Figure 12

Same-day delivery is the fastest-growing service type for e-commerce deliveries

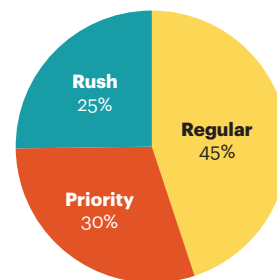
Same day-delivery market in US 2018–2022



Segmentation of same day-delivery market

by types of service 2018

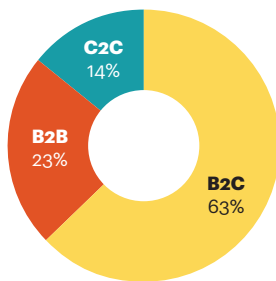
(revenue %)



Segmentation of same-day delivery market

by types of end user 2018 revenue

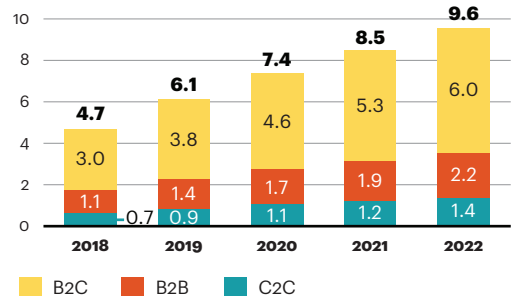
(revenue %)



Segmentation of same-day delivery market

by types of end user 2018–2022

(\$ B)



Note: B2C is business to consumer. B2B is business to business. C2C is consumer to consumer.

Source: Technavio

Same-day is also the reason that inventory locations are moving closer to the consumer. For example, Amazon recently built a 855,000-square-foot Staten Island fulfillment center, and the Walmart subsidiary Jet.com built a 200,000-square-foot distribution center in the Bronx. While same-day creates significant transportation issues, it also causes massive inventory replication. Whether or not you include mirrored inventory upstream as part of last-mile costs, same-day inventory replication is a burden for retailers. If you don't have an item in the right location, you have to fly it across the country, at your own cost. One of Amazon's biggest reasons for investing in airplanes is to reduce the time in transit—which then translates to lower inventories.

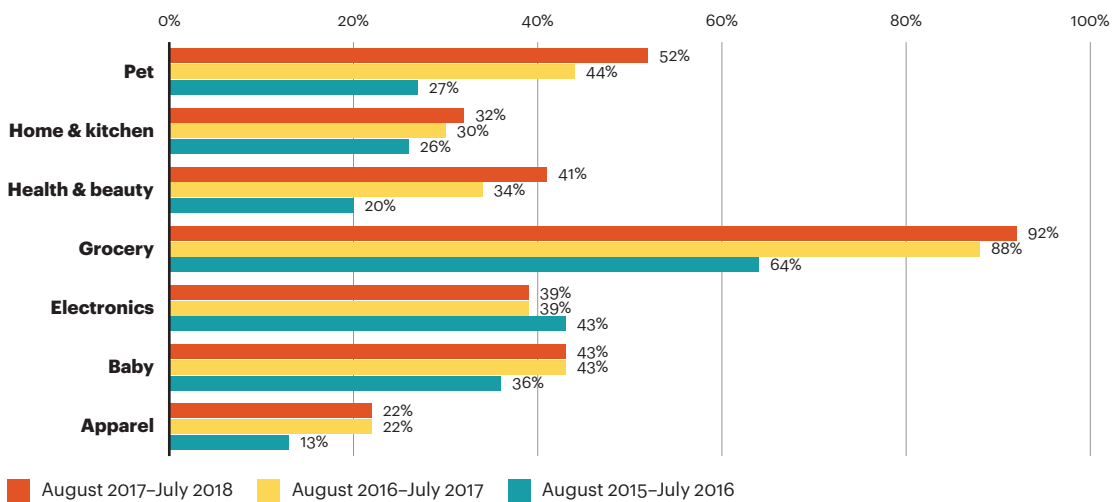
To truly understand the extent to which a company needs same-day, one needs to understand product and customer segmentation. While some products are worth delivering on the same day, others are not. Therefore, knowing the costs per package, service levels, and data risks will ultimately determine whether you should own assets, use a 3PL, or simply crowdsource your last mile.

For example, the popularity of click and carry for grocery products shows the value of product segmentation (see figure 13).

Figure 13

Click and carry has become a popular option for groceries at Walmart

Percent of Walmart banner sales via click and carry



Source: Rakuten Intelligence

Click and carry is also interesting because it is a type of same-day fulfillment that particularly benefits brick-and-mortars. As our report last year discussed, retailers with brick-and-mortar footprints are seeking to capitalize on their existing store locations in local markets to fulfill e-commerce orders with pickup in the store—in person, drive-through, or in a locker as Walmart is doing—or with delivery from the store, often using short-zone solutions such as crowdsourced local carriers to achieve same-day delivery. Target’s average distance chart shows they’re increasingly taking advantage of their retail footprint for fulfillment (see figure 14 on page 22).

Amazon’s two-day Prime delivery is evolving into one-day, as a defense against growing pressure from brick-and-mortar. Amazon’s guidance for the second quarter includes “approximately \$800 million of incremental spend related to this investment.” The Retail, Wholesale and Department Store Union said in a statement that it worries the increased workload could be bad for fulfillment-center employees where productivity is already high. Amazon’s other defensive moves include racing to open retail shops and gearing up to accept returns at all US Kohl’s department stores.

Partnerships abound. In grocery, Target’s late-2017 acquisition of Shipt may gain momentum now that a former Target senior vice president is taking over as Shipt CEO. Meanwhile, Walmart’s Spark Delivery is based on the delivery logistics platform Bringg. Deliv, backed by UPS and

Figure 14

Target's retail footprint reduces average delivery distance

Average distance travelled by Target.com deliveries (miles)



Source: Rakuten Intelligence

others, continues to expand. Home Depot has invested and partnered with Roadie.com for same-day delivery in select markets. In the pharmacy sector, in response to Amazon's acquisition of the online pharmacy PillPack, CVS has partnered with USPS and Shipt, and Walgreens with FedEx, to provide same-day and next-day prescription delivery.

In general, as retailers work through how to negotiate the tradeoffs among customer experience and operating costs, they are looking for innovative ways to design and operate their last mile—through alliances with providers or use of private fleets or warehouses. Smaller retailers are also rethinking how to compete effectively in this new world and are evaluating options outside of Amazon's platform. Traditional carriers have seen this need and launched fulfillment offerings that combine warehousing, fulfillment, and shipping for the smaller multichannel retailer. Over the past year UPS and FedEx have also invested in solutions such as UPS's Inception, a B2B e-commerce platform built on blockchain technology; UPS's Ware2Go, a technology platform matching available warehouse space and fulfillment services; and FedEx Returns Technology, a returns management solution for e-tailers. On the farthest frontier, FedEx recently revealed an autonomous delivery robot, the SameDay Bot, with Walmart, Target, and Walgreens participating in pilot projects, while UPS has partnered with drone start-up Matternet on FAA-approved drone deliveries of medical samples across WakeMed's hospital campus in Raleigh, NC.

In the end, not all companies need to chase the trained expectations set by Amazon, which in a way is required to go extraordinary distances to offset the brick-and-mortars' delivery time advantages. For the wise, however, needs-based segmentation will be key in allocating delivery windows to varying industries and products. For example, when Costco asked customers to click-and-carry rather than click-and-receive, it was widely accepted by its unique customer base. As companies continue to shed the mindset that freight costs must be recovered on a per-shipment basis, item baskets and membership models prove effective and a new era

emerges: compressing delivery windows has led to an ecosystem in which companies are forced to collaborate and form flexible alliances, innovators are rewarded, and industry embraces the challenges rather than necessarily chasing the trained expectations, all for the promise of sustaining and financing e-commerce growth. At this point, the privileged beneficiaries are consumers.

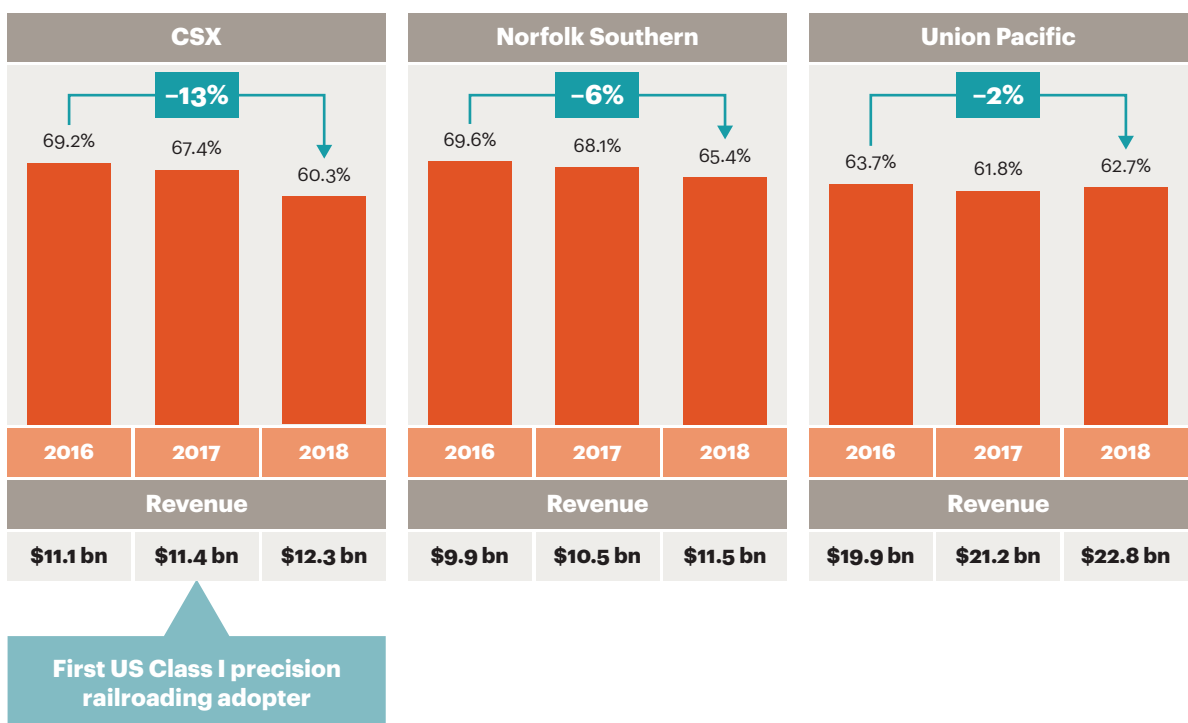
Rail: on track—for now

The year 2018 was a profitable one for North American Class I railroads. It was also the year that US Class I's broadly (and unfortunately posthumously) embraced Hunter Harrison's bold operating vision, implementing productivity improvement programs based on precision scheduled railroading (PSR) concepts. These programs drove considerable cost reduction and the strong pricing environment enabled significant improvement in operating ratios (see figure 15). Despite the improvements in profitability, rail customers experienced service issues related to weather, network congestion, site-level service, and railcar availability. Such issues resulted in pressure from regulators over service levels, transit times, and railcar supply. Notwithstanding these challenges, 2018 was a successful year for railroads as they approached their targets of sub-60 operating ratios. Like other major transportation providers, railroads continued their investment in technology—specifically, technology that enables enhanced shipper connectivity, shipment visibility, and the use of large railroad and customer data to apply predictive analytics to improve service levels and asset utilization.

Figure 15

Class I railroads are improving their operating ratios, with the earliest adopters outperforming

Example Class I operating ratios and revenue



Sources: Railroad 10k reports as published on investor relations websites; A.T. Kearney analysis

Railroad performance was strong across virtually all commodity markets. Union Pacific (UP), CSX, and Norfolk Southern (NS) reported gains in revenue per unit (a proxy for core pricing) in 2018. The railroads also reported healthy year-over-year total carload shipment gains (see figure 16). Both revenue per unit and carload gains were led by the intermodal segment. Railroads benefited from a tight trucking market that made it increasingly economical for shippers to convert volume from the road to the rails.

Figure 16

Large, publicly traded railroads saw broad improvements in revenue, volume, and revenue per unit in 2018

Year-over-year performance

(2018 vs. 2017, %Δ)

		CSX	Norfolk Southern	Union Pacific
Revenue	Merchandise	6% ↑	6% ↑	7% ↑
	Intermodal	7% ↑	18% ↑	14% ↑
	Coal	7% ↑	4% ↑	2% ↑
Shipment volume (units)	Merchandise	0% ↔	1% ↑	3% ↑
	Intermodal	2% ↑	7% ↑	6% ↑
	Coal	4% ↑	-1% ↓	-2% ↓
Revenue per unit	Merchandise	6% ↑	5% ↑	4% ↑
	Intermodal	5% ↑	10% ↑	7% ↑
	Coal	3% ↑	6% ↑	4% ↑

Sources: Railroad 10k reports as published on investor relations websites; A.T. Kearney analysis

Given the challenges faced by shippers, the financial gains generated by PSR—CSX, the first US Class I to implement PSR, has generated industry-leading operating ratios—and the emphasis placed on PSR by rail executives, it is important to understand how railroads have implemented the current version of PSR. At its core, PSR requires that railroads operate on a schedule similar to airlines, with precisely timed departures and arrivals. As with airlines, this requires freight to be available when trains are scheduled to depart, to keep the network moving fluidly. Operating a scheduled railroad is not a new concept. In fact, Class I’s have operated scheduled service for years, particularly in their premium networks (for example, intermodal and automotive). The key difference is that railroads are increasing their focus on asset and labor productivity. This is done by tightly managing head counts, locomotives, and rolling stock fleet. The railroads have actively looked to reduce their operational footprints by utilizing large hump yards, shops, non-core rail lines, and other assets to improve productivity. Given the sprawling, interconnected, and labor-intensive nature of the rail business, this process has caused shippers to experience localized service failures and extended transit times. The good news for shippers is that as railroads roll out change management programs and fully implement the concepts, measures of service (for example, train speed and network fluidity) have improved at the earliest adopter, CSX.

In response, several railroads, including UP and NS, have emphasized customer collaboration by rolling out their versions of PSR known as Unified Plan 2020 and TOP21, respectively. NS has taken a slightly different approach to PSR implementation by focusing on “clean sheeting” efforts. In collaboration with select customers, NS seeks to make local-level operating plan changes to improve results by looking at operating practices at individual terminals or districts. On the other hand, UP is taking a more regional approach to the rollout of its productivity programs. While the publicly traded railroads have focused on PSR implementation, Berkshire Hathaway–owned BNSF has taken a more balanced approach by pursuing profitable, balanced growth through less explicit management emphasis on productivity.

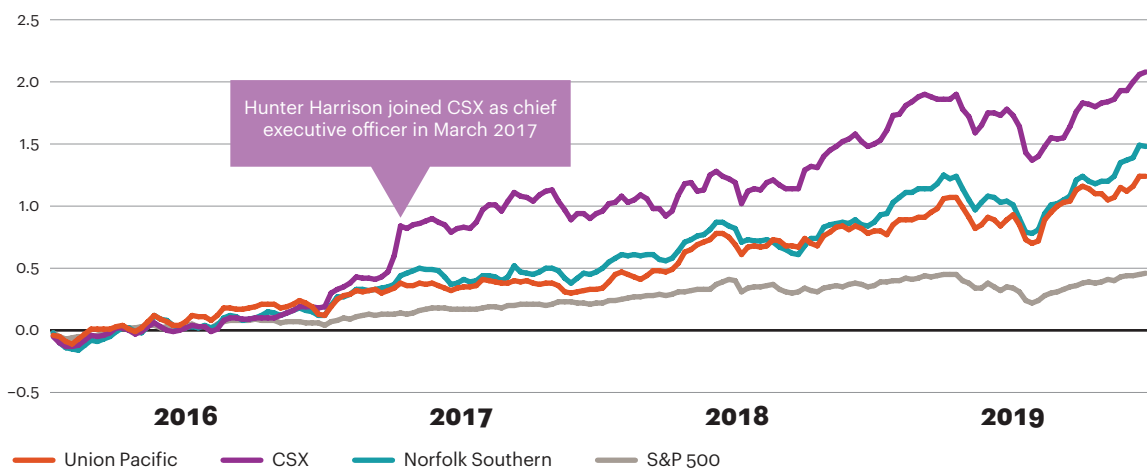
Since the push to increase the use of PSR concepts in the United States began in 2017 at CSX, the railroads have generated impressive returns (see figure 17). The drive to constantly improve operating margins does however represent an emerging risk for railroads. This is due to the potential for government intervention and their role as a common carrier of freight. Moreover, railroads have historically advocated for equitable investment in transportation infrastructure. Specifically, railroads are responsible for 100 percent of their capex while motor carriers benefit from “subsidy” investments in road infrastructure. As rail margins improve and capex is closely managed to hit free cash flow targets, the railroads run the risk of public (and government) ire.

Figure 17

Railroads have significantly outperformed the S&P 500 since 2016 as they implemented precision railroading

Stock performance of select Class I railroads and the S&P 500

(Indexed, January 2016 = 100)



Sources: Google Finance; A.T. Kearney analysis

Water and ports: trade winds and breaking waves

The year 2018 made for interesting times in ocean shipping markets with two strong forces at play: geopolitical trade tensions and changing industry dynamics.

US-China trade tensions had a profound impact on the typical seasonality of ocean shipping volumes. Seeking to build inventory in advance of an expected 25 percent tariff to begin January 1, shippers began pulling shipments forward. Container imports grew 3.7 percent to the

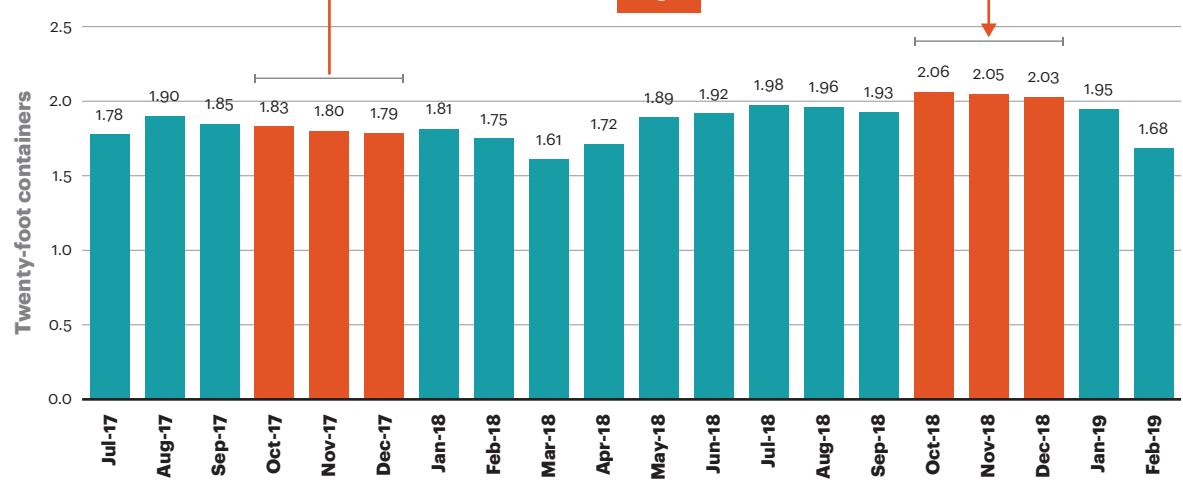
US East Coast and 8 percent to the US West Coast in the first 11 months of 2018, according to the Baltic and International Maritime Council (BIMCO). To beat the January 1 tariff increases, several shippers pulled forward inventory, extending the year's peak season beyond October (see figure 18). In fact, Q4 saw an extraordinary 13 percent spike in imports over the previous year. The scramble for capacity gave carriers the upper hand as they opportunistically rolled contracted cargo in favor of higher-paying spot cargo and preferential treatment for shippers who had painstakingly built good relationships with the carriers.

Figure 18

Looming tariffs led to increased container traffic in the fourth quarter of 2018

TEU

(millions, 2017–2019)



Notes: Represents data for 16 container ports in the US. TEU is twenty-foot equivalent.
Sources: PMSA West Coast Trade Report; A.T. Kearney analysis

Meanwhile, after several years of intense merger activity, 2018 saw no significant deals. With three major alliances (across seven carriers) now addressing about 90 percent of the market, carriers focused on operationalizing these alliances to gain profitability. It's not easy: the Japanese alliance Ocean Network Express (ONE) posted a \$600 million loss in its debut year due to employees being unfamiliar with systems and underprepared for administrative processes. Generally, the industry was slightly profitable for the year but nowhere near the estimated \$7 billion in profits for 2017 as rising bunker costs, which comprise almost half of operating costs, had a telling effect. Maersk's fuel bill rose 35 percent over 2018 but the carrier still managed to eke out a \$220 million profit from continuing operations, buoyed by the successful integration of Hamburg Süd.

The alliances are already having an impact. Ocean shipping in the past has been marked by seeking to undercut competitors' prices. Capital and operating costs are so high that carriers feel pressure to achieve full utilization, even if price wars end up making that utilization uneconomical. Remarkably, in 2018 carriers manifested more discipline in resisting those price wars than before. While global capacity grew at 5.7 percent—outpacing 4.4 percent demand growth—rates were at times the highest they have been over the past three years. Carriers were disciplined in their capacity deployment, especially during peak season when they often followed through on blank sailings (the cancellation of scheduled voyages).

The combination of high demand and carriers' capacity curtailments led to 2018's record-high ocean shipping rates. Transpacific rates during the peak season doubled over 2017 with spot rates on the transpacific West Coast surging from \$900 in March to \$2,500 in November, and the East Coast spot rate rising from \$1,900 to \$3,700 over the same period, according to Freightos. Much of the world did not experience the same growth in rates that the US witnessed—Drewry's World Container Index posted a 30 percent increase over 2018.

In other ocean modes, the same sentiments manifested differently, telling confoundingly different stories. For example, the Baltic Dry Index (BDI), a leading indicator of global economic activity, which measures the cost to carry raw materials such as iron ore on giant bulkers, rose through the first three quarters of 2018. Then it bucked the trend of a strong finish to the year, by falling 50 percent as of Q1 2019. Overcapacity was not the cause—the global fleet expanded by less than 3 percent, with capacity additions the lowest they have been in a decade. Other potential causes included the Brazilian mine disaster, a train derailment at a BHP mine in the Pilbara, and a softening Chinese demand for coking coal and iron ore.

Oil tanker demolition reached a 30-year high in capacity terms with more than 100 vessels being sent to the scrapyards. The reduced capacity sent rates soaring.

Oil tanker demolition reached a 30-year high in capacity terms with more than 100 vessels being sent to the scrapyards. The reduced capacity sent rates soaring as sanctions on Iran spurred OPEC+ to increase output, with Russia and Saudi Arabia collectively pumping an additional 1.5 million barrels per day into the export market. The result was a near tripling of rates across asset classes in the final quarter of the year with very large crude carriers (VLCCs) earning a cool \$60,000 a day, the highest in nearly three years. At the start of 2019, a planned production cut by OPEC+ promised to dampen the tanker market. On the other hand, the widening spread between West Texas Intermediate (WTI, the US price benchmark) and Brent Crude (the North Sea benchmark), coupled with record output from US shale fields, has shifted demand to the US Gulf Coast and sustained the high rates that characterized the end of 2018.

In labor developments, the International Longshoremen's Association (covering the East and Gulf Coasts) and United States Maritime Alliance signed a six-year contract. The union was pleased that ports would not implement "fully automated equipment"; ports were pleased to gain flexibility in scheduling in the event that a vessel doesn't arrive on time. With a 2024 horizon (while a West Coast deal lasts through 2022), the agreement hinted at coming labor stability.

However, labor is objecting to automation at the port of Los Angeles. In March 2019, International Longshore and Warehouse Union members protested Maersk's plans to use unmanned electric vehicles instead of diesel trucks to move shipping containers around the nation's largest port. Because the union contract does allow such automation, the aggrieved employees asked harbor and city officials to step in. With the company countering that the automated vehicles have environmental benefits, politics could get complicated quickly.

Labor difficulties were not the only issues the major port complexes had to deal with. A shortage of chassis to dray containers out of the ports and to warehouses crippled port operations, increasing dwell times and demurrage charged to shippers. Many underlying forces were at play, including congestion at intermodal railheads, unexpected frontloading of freight, and changing domestic trade routes brought about by the transforming face of commerce.

Innovations to keep an eye on include the following:

- Blockchain was a hot topic in maritime circles, with Maersk and IBM continuing their collaboration on TradeLens, a blockchain platform that now has more than 100 participating organizations and has captured 236 million shipping transactions. The May 2019 addition of CMA-CGM and MSC Shipping as partners gives much-needed credence to TradeLens, which faces direct competition from the Global Shipping Business Network (GSBN) consortium, an open digital platform based on blockchain technology and supported by several leading players, including COSCO, CMA-CGM, and DP World. GSBN's goal is to enable trustworthy, secure, credible, and open cooperation among all participants in the ocean value chain.
- The New York Shipping Exchange (NYSHEX), a digital ocean freight platform, launched in 2018 and attracted carriers including Maersk. It's now also marketing itself to Asia-based forwarders and carriers. NYSHEX and similar brokerages such as Freight.AI offer shippers the opportunity to access ocean carriers without a freight forwarder. Only time will tell if these new platforms succeed in driving price transparency, contract enforcement, and service reliability. In fact, an analysis by Sea Intelligence Consulting found that 49 percent of the time, shippers did not choose the lowest price, instead seeking out carriers with a reputation for service.
- Two Norwegian companies, Yara and Kongsberg, have teamed up to build an autonomous container ship, unmanned and fully electric, which would run a short domestic route to replace 40,000 truck roadway trips per year. Companies in China and the Netherlands are also investigating electric ships.

Initial reports on contract negotiations have indicated 15 to 20 percent gains for carriers in 2019.

Given the inventory pull-forward last year and the impending January 1 tariffs, the demand outlook for 2019 was expected to be lower, with leading carriers projecting less than 3 percent growth. The first quarter was characterized by the traditional slack demand during Chinese New Year, followed by capacity curtailments with carriers posturing to prop up spot-market rates ahead of upcoming annual contract negotiations. So far Q1 has seen rates decline by about 15 percent from January—but they remain higher than the same period last year, consistent with initial reports on contract negotiations that have indicated 15 to 20 percent gains for carriers over 2018 contracts.

The contracts offer some stability for the rest of the year, but clearly the future will hold more turmoil. First will be the implementation on January 1, 2020, of the IMO 2020 sulfur regulations. Two potential carrier responses—installing scrubbers or switching from marine fuel oil to

liquefied natural gas—would involve significant capital expenditures. The other alternative, burning low-sulfur fuel oil, would rely on a supply market that hasn't previously existed. Refineries were reluctant to start making low-sulfur fuel until they knew it would be used, while carriers were reluctant to commit until they knew its availability and pricing. Alphaliner analysts estimate that the cost of compliance will be close to \$10 billion, with nearly 20 percent of global capacity being transitioned to scrubber-based systems. They opine that the biggest uncertainty for the industry is in the cost of low-sulfur fuel oil. A.T. Kearney's analysis on the cost of compliant fuel indicates that the spread between the current high-sulfur fuel and the required low-sulfur fuel will be \$50 to \$350 per ton when IMO 2020 goes into effect, equalizing only around 2025 (see figure 19).

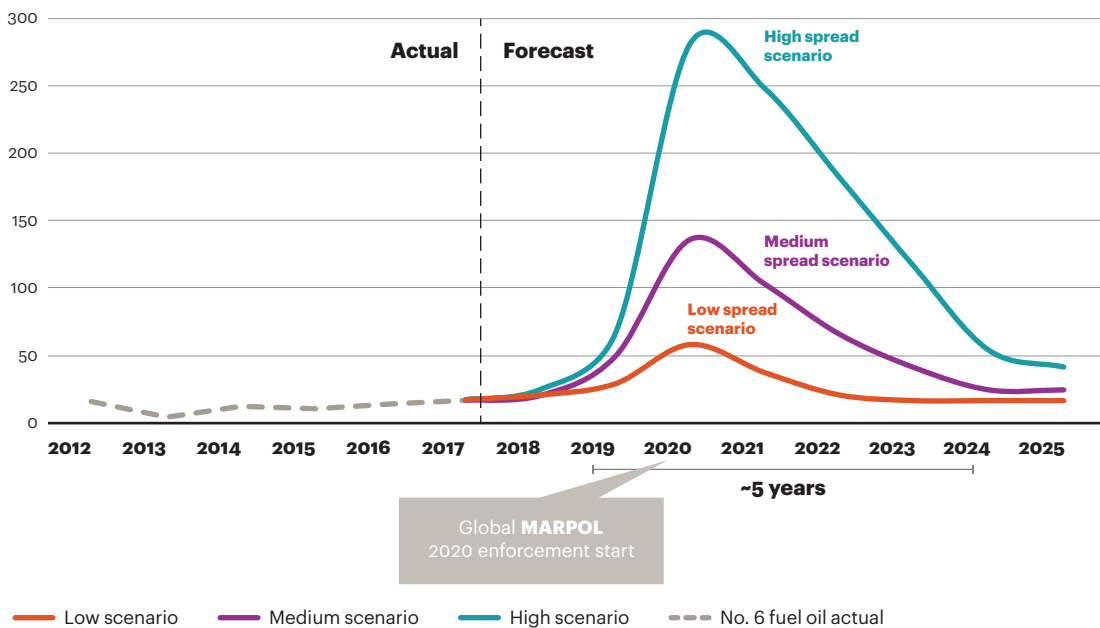
Figure 19

There is tremendous uncertainty surrounding the cost of low-sulfur fuel oil

1% LSFO and currently used 3.5% sulfur fuel oil price spread¹

(2012–2025)

USD/ton



¹ No. 6 fuel oil (1% vs. 3.5% sulfur weight percentage)

Note: LSFO is low-sulfur fuel oil.

Sources: Bloomberg; A.T. Kearney analysis

The fuel oil pricing uncertainty has led to additional questions surrounding the bunker adjustment factor (BAF), a carrier surcharge related to oil prices. Currently, each carrier handles BAFs differently, and there are calls to make them standardized and more transparent. Moreover, carriers appear to be downplaying their scrubber strategy so as to maintain narratives around the high cost of fuel.

Finally, the world continues to live with global trade uncertainty. Tariffs or trade wars could decimate global shipping—and even threats and expectations can cause great movement, as we saw in late 2018. That said, with the ever-elusive supply-demand balance in sight, and the race to comply with regulation, 2019 is shaping up to be an action-packed year in the maritime industry.

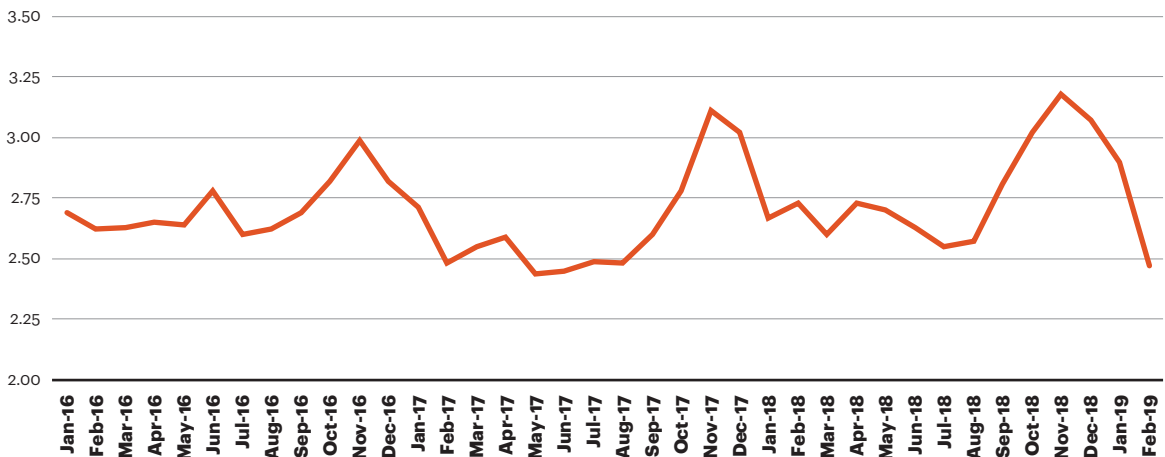
Air freight: soaring on e-commerce

As the global inventory restocking cycle ended in 2018, air freight volumes moderated, rising by 3.5 percent globally, far less than the 9.7 percent growth experienced in 2017. North America was the fastest-growing region at 6.8 percent. Manufacturing slowdowns have continued the softening of air freight volume growth toward the end of 2018 and into 2019. The International Air Transport Association (IATA) has since downgraded the forecast of global air freight growth in 2019 from 3.7 percent to 0 percent, with continued weakness showing in many leading indicators, such as semiconductor sales and the Purchasing Managers' Index. Despite risks of slowing global economic growth and concerns over trade wars, specialized cargo and e-commerce shipments will continue to drive longer-term volume growth.

Freight capacity rose by 5.4 percent in 2018, outpacing the growth in demand resulting in a fall in load factors. Despite load factors falling, rate discipline by carriers saw air freight rates increasing in 2018, jumping about 5 percent year-over-year in the East-West lanes (see figure 20). Rising rates and continued growth saw record cargo revenues for many players in the industry such as Atlas Air, United, American, and Delta. On the cost side, with jet fuel pricing in 2018 increasing about 30 percent year-over-year before falling to its lowest point at the end of the year, carrier exposure to fuel costs will continue to challenge cargo operators.

Figure 20
Air freight rates jumped by 5% for East-West lanes in 2018

Drewry East-West average air freight rate (\$ per Kg)



Note: Weighted average of all-in airfreight buy rates paid by forwarders to airlines for standard deferred airport-to-airport airfreight services on 21 major East-West routes. Rates are expressed in \$/kg and include three components: the base rate, the fuel surcharge, and the security surcharge.

Sources: Drewry; A.T. Kearney analysis

Air freight hubs are becoming increasingly important in enabling continued growth from e-commerce shipments and specialized cargo such as pharmaceuticals and perishables. Dallas/Fort Worth International Airport is investing to establish itself as a gateway for the pharmaceutical industry by acquiring the IATA pharmaceutical certification. At New York's JFK airport, Worldwide Flight Services and Swiss WorldCargo opened a new certified facility to handle pharmaceutical products.

Capitalizing on the e-commerce growth

The International Post Corporation estimates that cross-border e-commerce, a key growth driver of air freight, accounts for 22 percent of global online commerce. As e-tailers push for faster door-to-door delivery of cross-border air shipments, to capture e-commerce growth, carriers must assure future capacity and speed up processes to reduce delivery time from today's average of 5 to 7 days.

Cargo carriers are clearly accelerating investments to respond to e-commerce demand. With demand for freighters forecasted to outstrip the current production rate, cargo carriers have been securing older passenger jets for freighter conversion to ensure long-term capacity. ATSG purchased passenger airline Omni Air to ensure a supply of freighters, citing that the investment will allow future capacity growth for e-commerce. Sixty percent of Atlas Air's freighters are dedicated to e-commerce and express shipments. Amazon is increasing capacity by adding narrow-body 737s from GE Capital Aviation Services to its existing wide-body 767 freighter fleet. In the international express segment, DHL has invested in a new facility near Minneapolis-St. Paul International Airport to accommodate the growth of e-commerce.

With demand for freighters forecasted to outstrip the current production rate, cargo carriers have been securing older passenger jets for freighter conversion to ensure long-term capacity.

Internationally, China's e-commerce giants Alibaba and JD.com have been investing heavily in building both cross-border and domestic air freight capabilities and capacity. Alibaba Group has partnered with both Singapore and Emirates Airlines to facilitate the delivery of cross-border shipments while JD.com launched its own freighter service within China, perhaps looking to replicate Amazon's use of air freight in the United States.

Beyond ensuring capacity, the air freight industry must also modernize and embrace digitization to increase efficiency, reduce delivery times, and fully capitalize on e-commerce growth.

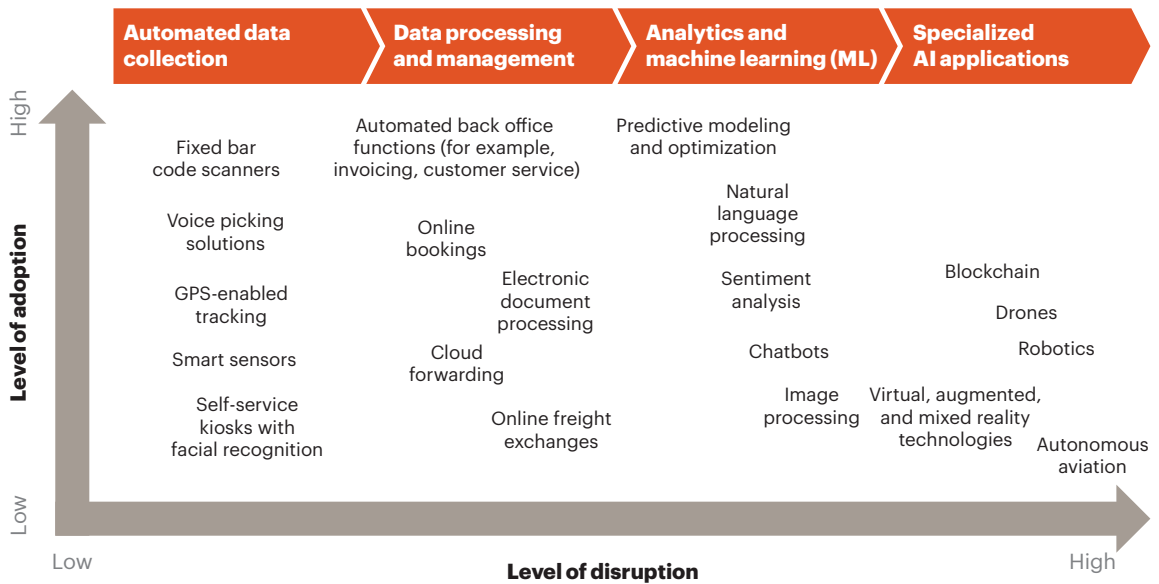
Digitization finally comes to the fore

The air freight industry has in the past year made strides in digitization, including Internet of Things (IoT) tracking and visibility, automation of back office and freight services, and other specialized applications such as blockchain. The traditionally slow-moving industry likely still faces a long and arduous road to providing an integrated and streamlined end-to-end process powered by artificial intelligence, machine learning, and even deep learning, but a corner has been turned.

The road can be described in four phases, moving from automated data collection through higher-level data processing and then more sophisticated analytics and specialized applications (see figure 21).

Figure 21

The air freight industry has turned a corner in digitization



Source: A.T. Kearney analysis

While features such as GPS-enabled tracking are now more common, 2018 brought second-phase advances. For example:

- Airlines and freight forwarders are expanding real-time **smart sensor** technologies to track and monitor shipments. Carriers of high-value cargo requiring special handling—such as pharmaceuticals—are making such sensors a standard practice. For example, Delta Cargo can now provide shippers with real-time visibility into time-sensitive international air shipments thanks to GPS-enabled Bluetooth tracking, and Kerry Logistics offers smart sensors for full supply-chain visibility in real time on crucial parameters such as temperature, pressure, tilt, humidity, and shock.
- Companies are also increasingly implementing digital solutions for **back-office automation**, including customer assistance, inquiries, and bookings. For example, Delta Cargo reported that online bookings are now its primary booking method, and it has launched self-service iPad kiosks in Atlanta and Boston. Similarly, Kuehne + Nagel’s newly launched NextGen enables online booking, tracking, and invoicing.
- IATA continues to drive toward eliminating paper from air freight to improve efficiency and reliability. **Electronic air waybill** (eAWB) penetration is above 60 percent and is now the default contract of carriage on select lanes. In addition, 2018 brought about pilots and tests of a standardized digital shipment record that will continue into 2019 as part of IATA’s “ONE Record” project.

All these digitization efforts create more structured data that will aid in future machine-learning applications, which could eventually result in disruptive solutions for cost reduction. To date, air cargo is not yet seeing the shake-ups of freight forwarding, where start-ups such as Flexport are attracting venture capital investment. In air freight’s biggest current disruption, online freight exchanges such as Freightos and Xeneta are connecting shippers directly with airlines, providing shippers with increased rate transparency and supporting the launch of dynamic pricing for Air France KLM Cargo.

One oft-talked-about trend is blockchain, and in 2018, Singapore’s Cargo Community Network (CCN) and Microsoft launched a blockchain-based billing, costing, and reconciliation system for air cargo to minimize billing discrepancies and expedite reconciliations. Similarly, the start-up CargoX launched an open blockchain-based platform for applications in modes including air.

Although the intensifying trade war has dented near-term growth in air freight, e-commerce growth and continued digitization will continue to lift the industry in 2019 and beyond.

Pipeline: capacity slowly catches up

In 2018, demand for oil and gas remained strong, powered by gasoline motors, electricity generation, and exports. Demand fueled record-high production increases—17 percent for oil and 11 percent for natural gas. Sudden increases can squeeze pipeline capacity, but by late 2018, constraints eased as a result of recent investments. Growing pipeline capacity should lead to fewer shortages and lower pipeline transportation prices in 2019 and beyond.

Marcellus gas powers electricity and exports

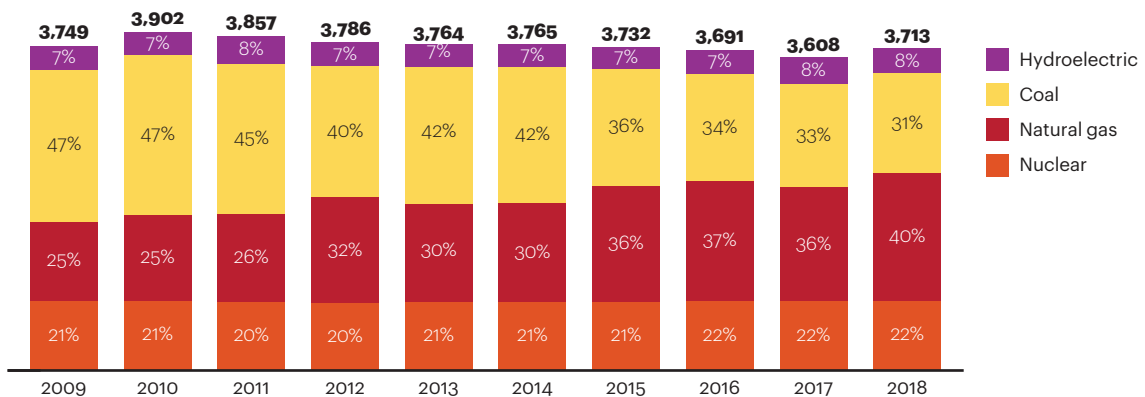
In 2018, natural gas fueled more than 60 percent of newly installed US electric generating capacity. Culminating a decades-long trend, it outpaced coal as the leading source of electricity (see figure 22). As coal continues to decline, gas is expected to fuel more than 50 percent of the 434 gigawatts of total planned expansion of electricity generation by 2050.

Figure 22

Gas has surpassed coal in electricity generation

Net electricity generation by fuel type

(Thousand GWh)



Notes: GWh is gigawatt hours. Numbers may not resolve due to rounding.

Sources: EIA – Electricity Monthly Update; A.T. Kearney analysis

Furthermore, the US is becoming a net exporter of natural gas (see figure 23). Total natural gas exports grew 14 percent in 2018, driven particularly by exports of liquefied natural gas (LNG), which grew by 53 percent, and by increasing pipeline exports to Mexico.

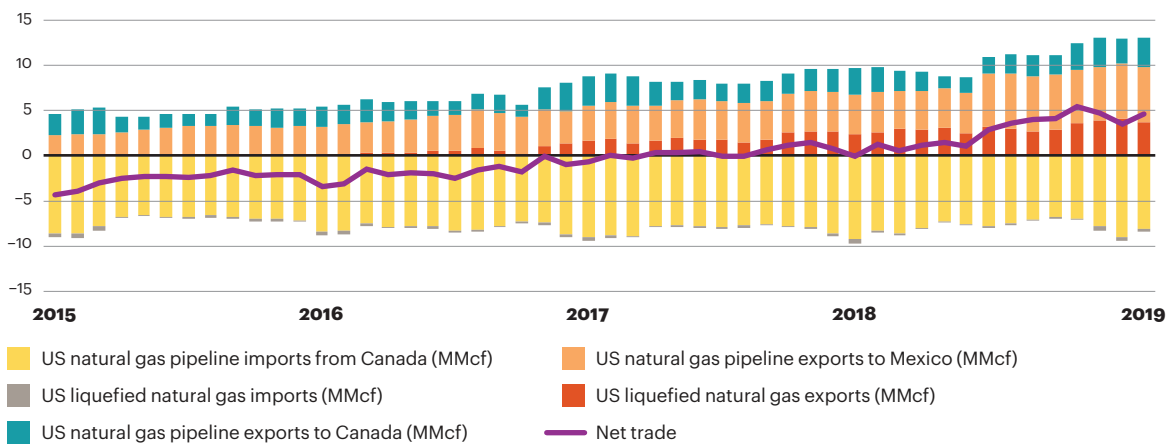
To meet all this new demand, gas production rose in 2018 by 10 billion cubic feet per day (Bcf/d), averaging 101.3 Bcf/d as measured by gross withdrawals, according to EIA. Production is increasingly from shale gas and continues to be concentrated in the Pennsylvania–West Virginia Marcellus shale formation (see figure 24).

Figure 23

The United States has become a net exporter of natural gas

Monthly US natural gas trade

(Billion cubic feet per day, January 2015–February 2019)



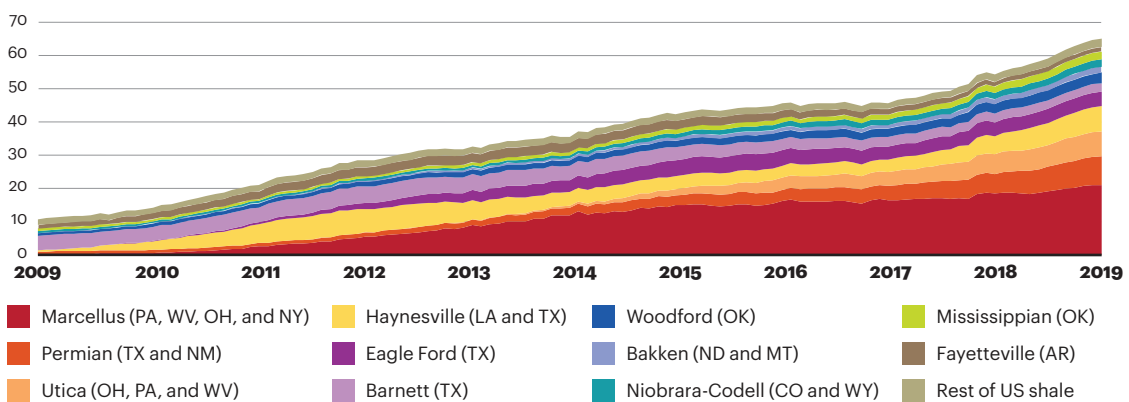
Note: MMcf is million cubic feet.
Sources: EIA – Natural Gas Monthly; A.T. Kearney analysis

Figure 24

Gas production rose substantially in 2018, largely due to increased shale gas production

Shale gas production

(Bcf/d)



Note: Bcf/d is billion cubic feet per day.
Sources: US Energy Information Administration; A.T. Kearney analysis

In 2018, 10 new pipeline projects created almost 10 Bcf/day of capacity, while 29 expansion projects created another 7.5 Bcf/day. Additional lateral and reversal projects brought the total new capacity to 26 Bcf/day. Expansion of another 30 Bcf/day is planned for 2019.

A majority of that expansion is within the Northeast region, with most of the remainder extending from the Northeast to other regions. (Outbound gas pipeline capacity in the Northeast region has increased 76 percent in the past 10 years.)

Permian oil flows worldwide

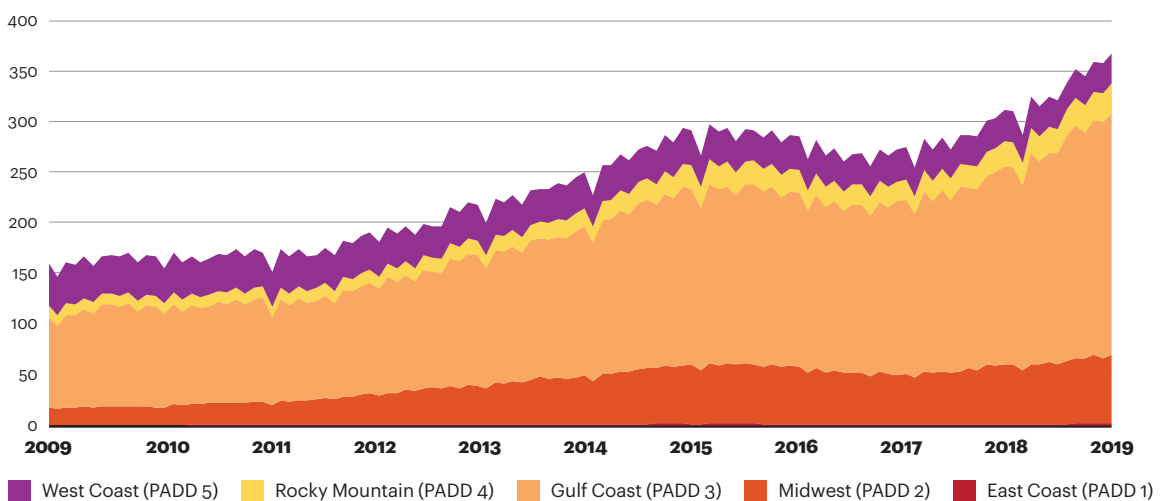
In 2018, global oil prices remained in the \$60–70 range, slightly higher than 2017 and far above the previous year’s lows, ensuring that oil producers had incentives to increase supply. Additionally, US producers are still responding to the lifting of the crude oil export ban, which gives them access to the world market. By December 2018, exports were over 2.5 million barrels per day (b/d), a fivefold increase over two years prior.

US crude oil production saw a major increase, 17 percent, in 2018, reaching an annualized average of almost 11 million b/d, with a monthly high of nearly 12 million b/d in December. Production was increasingly concentrated in the Permian Basin of Texas and New Mexico, which accounted for 73 percent of the production increase (see figure 25).

Figure 25

Crude oil production reached almost 11 billion barrels per day, led by the Gulf Coast region

Crude oil production (thousand barrels/bn)



Note: PADD is Petroleum Administration for Defense Districts.
Sources: US Energy Information Administration; A.T. Kearney analysis

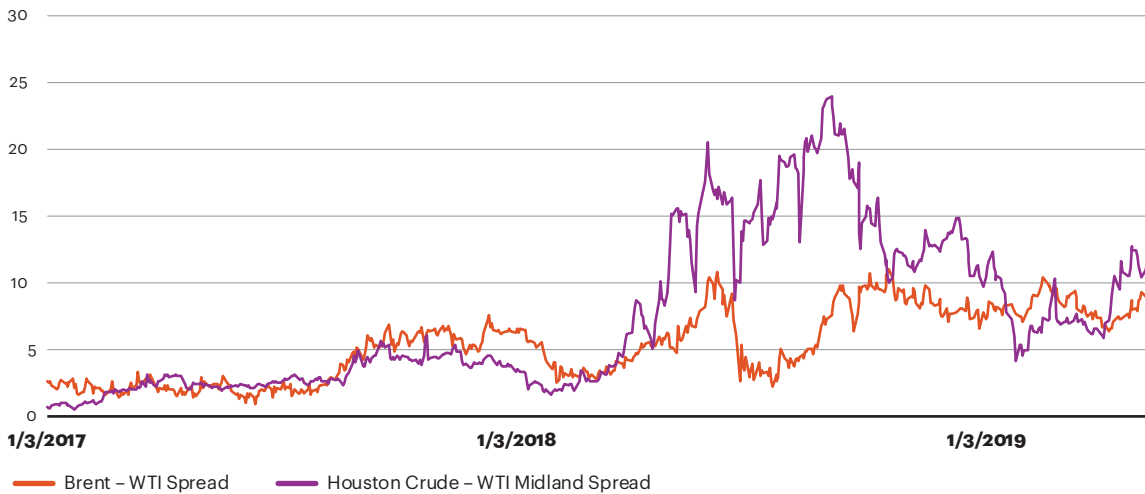
As production ramped up, pipeline capacity proved a constraint. In mid-2018, the price of crude oil in Houston, with its export-fueled demand, far exceeded the price in Midland, in the Permian production area, because some of that Permian oil had to be transported through more expensive non-pipeline modes (see figure 26 on page 36). Then, as new capacity was added through the year, the price spread narrowed. By early 2019, price spreads nearly reflected the incremental price of pipeline transport, indicating that increased supply was reaching Houston via pipeline.

Figure 26

Pipeline capacity constraints have resulted in price differences

Spreads: Brent (WTI) and Houston crude (WTI Midland)

(USD per barrel)



Note: WTI is West Texas Intermediate.

Sources: Bloomberg; A.T. Kearney analysis

Private equity investment continues to pour into the pipeline sector (\$15 billion invested in 2018, compared to \$9.3 billion the previous year). With depressed valuations of midstream companies in the public markets, private equity funding has become a way to raise capital for new projects, either through joint ventures or sales of non-core assets to private equity players.

Constraints will continue to loosen through 2019, as capacity could increase by about 50 percent with the onboarding of more than 2 million b/d in new projects. These new capacity additions should keep pipeline prices lower than their 2018 highs.

In early 2018, master limited partnerships (MLPs) faced the possibility that the US Federal Energy Regulatory Commission (FERC) would disallow the recovery of income taxes from cost-based tariff rates for MLP-owned interstate pipelines. That could have given shippers leverage to push down rates. The final FERC ruling proved more benign than expected and was seen as largely positive for the pipeline sector. In additional positive regulatory news, two executive orders announced in April 2019 are aimed at reducing regulatory barriers to new pipeline construction. One makes it more difficult for states to object to pipelines; the other eliminates a lengthy review process for international pipelines, such as Keystone XL.

Although 2019 gas and diesel prices are expected to decline, the volume of demand for crude and refined products is expected to remain high. Pipeline operators' revenues are tied more to volumes than to prices, so if demand stays high and US production costs stay sufficiently lower than global prices, the pipeline sector would be little affected. A bigger concern would be if a global recession were to reduce demand. However, current estimates stop short of predicting a full-blown recession or a return of the 2016 nadir of prices; thus US production should keep growing, and pipeline demand will remain strong.

Freight forwarding: value of relationships

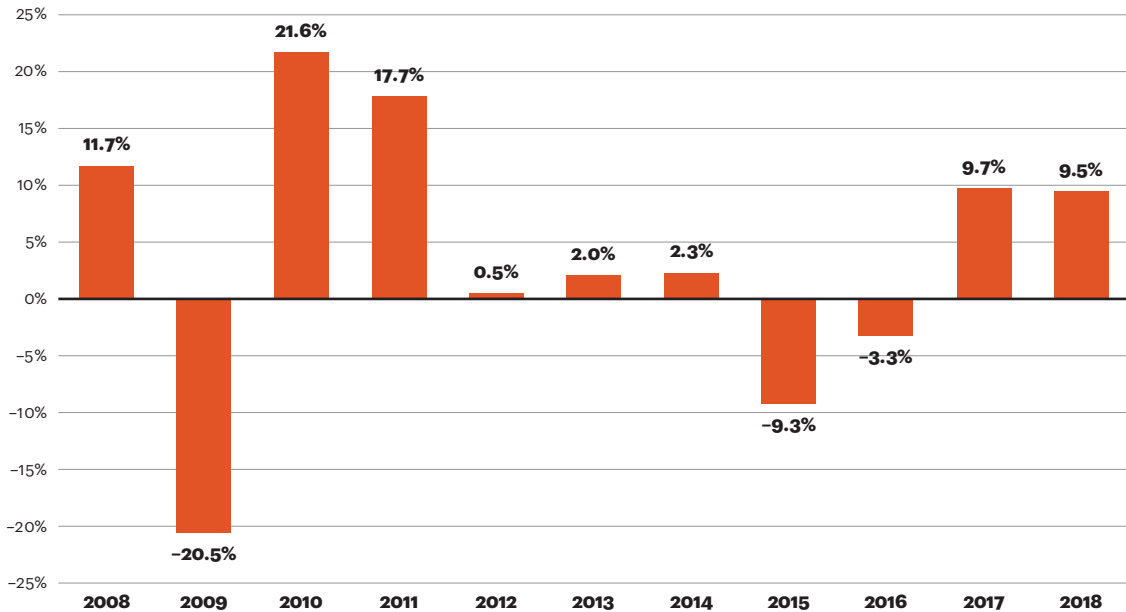
Freight forwarding is the world's [most profitable industry](#), even more profitable than high technology when looked at through the lens of return on capital employed (ROCE). Despite global commerce in 2018 being characterized by the Brexit dilemma and the US-China trade spat, global trade grew 9.5% according to the World Trade Indicator published by freight forwarding giant Kuehne + Nagel (see figure 27). Notably, the last quarter saw the Americas grow faster than the rest of the world as businesses scrambled to build inventory ahead of the January 1 deadline for tariff increases.

Figure 27

World trade growth exceeded 9 percent for the second consecutive year

Global trade growth

(Year-over-year, in USD, 2008–2018)



Sources: gKNI (Global Kuehne + Nagel Indicators), operated by LogIndex AG

The strength of freight forwarding comes from customer service in a complex world. For example, one large high-tech company said that its ability to secure capacity during last autumn's peak-season/pull-forward rush benefited from its strong relationships with forwarders. Such demand flowed through to the bottom lines of freight forwarders: Panalpina, DSV, DHL, and Agility all reported high single-digit revenue growth with double-digit jumps in profits. US-based Expeditors had a strong year with profitable growth in ocean and air volumes—net revenue grew 13 percent and operating profit rose 14 percent.

Air freight demand was strong but cost pressures were also front and center, as a pilot shortage and fluctuating fuel prices caused a 15–20 percent increase in fourth-quarter carrier rates, which forwarders found difficult to pass on to their customers.

Relatively high ocean rates also put cost pressures on forwarders. Yet tight capacities may also have benefited forwarders that had good relationships with ocean carriers. When capacities are

tight, a carrier that has only a transactional relationship with a shipper will meet only the minimum commitments of their contract, forcing any additional shipments to pay spot-market rates, which can be twice contract rates. Relationships that are deeper, or even personal—as is the case between many carriers and freight forwarders—can come in handy in difficult times. The other bright spot for forwarders was that burgeoning e-commerce volumes, particularly in cross-border retail, drove growth in the value-added warehousing and distribution operations they offer.

M&A activity picked up after a couple of slow years. The fate of Panalpina brought excitement in early 2019 as the Swiss company rebuffed a bid from Danish major DSV. Many other firms were in contention for the deal, with a merger with Kuwait-based Agility looking likely, while rumors speculated about a deal with Kuehne + Nagel or even Maersk. Ultimately, a revised \$4.6 billion bid from DSV won shareholder approval in March. The new venture becomes the fourth-largest forwarder in revenue terms, behind only DHL, Kuehne + Nagel, and DB Schenker. In 2016 DSV acquired and successfully integrated US-based UTi Worldwide for \$1.35 billion, but this M&A success is no indicator for the company given that Panalpina is much bigger in almost every dimension. The industry will be watching closely as the integration unfolds.

In other merger developments, CEVA is being acquired by the French ocean carrier CMA CGM. The acquisition will help the carrier become more of an integrated logistics player, a strategy being pursued by other rivals such as Maersk. The carrier intends to operate CEVA as an independent unit and brand within the CMA CGM Group, without favoritism over other forwarders in rates and capacity allocations on its vessels. But XPO, which was speculated to be interested in acquisitions, sat on the sidelines. This industry is heavily fragmented, with the top 20 players accounting for just one-third of the market, so additional consolidation makes sense, and is possible, but is complicated by the fragmentation, and acquisitions are likely to be of niche players.

The industry also seems poised for disruption. The start-up Flexport tripled its valuation in the past year, to 3 billion dollars. Its software-focused approach is a darling of Silicon Valley, but its \$441 million in 2018 revenues also represented a 95 percent annual growth rate. Yet even Flexport paled next to Amazon, which is looking more and more like a freight forwarder. Amazon was already a non-vessel operating common carrier (NVOCC), and now also owns 50 planes and 20,000 vehicles. It helps sellers move goods on ships and through warehouses, and aggregates loads from various customers. Of course, most people think of Amazon as a retailer rather than a freight forwarder. But imagine if CEVA or Panalpina scuttled current plans to instead merge with, say, eBay—that's the kind of disruptive company that Amazon appears to be building, a freight forwarder with a retail marketplace layered on top of it. Meanwhile, carriers are also making forays into the freight forwarding market, aiming to directly reach smaller shippers with niche needs who make up the bedrock of forwarders' customer base. For example, Maersk recently announced its desire to become the "UPS of container shipping." Nevertheless, Maersk's CEO said that carriers would always struggle to match the level of service that forwarders provide to smaller shippers.

In essence, freight forwarding is a low-asset, paperwork-intensive business—which means it's a hotbed for innovation. In coming years, digitization and blockchain-based solutions will offer great promise to do this work more efficiently. Freight forwarders could help carriers improve visibility while supporting shippers in anticipating risks. In an age of climate concerns—the kind of all-encompassing, cross-modal issue that could be tailor-made for a hybrid, cross-modal, disruptive freight forwarder—consumers are increasingly demanding transparency. On the other hand, going green is expensive, which puts it in opposition to the cost pressure that players in the freight business are always subject to—even from their climate-conscious customers.

At the start of the year the outlook for freight forwarding looked promising, with global trade expected to be respectable. Then trade tensions escalated, in ways that are sure to leave a mark on the fortunes of forwarders. The industry will also be keeping an eye on the integration of Panalpina and DSV's operations before we are likely to see other blockbuster deals. Technology will continue to play a part in shaping the industry as we have seen over the past year. While all this might change the landscape of the industry, freight forwarders' focus on customer needs will be pivotal to their endurance and continued profitability.

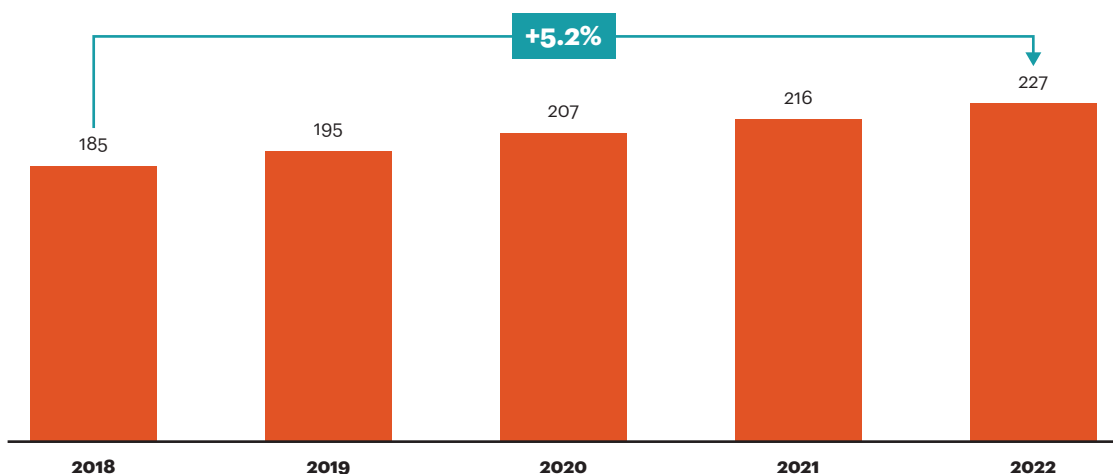
Third-party logistics: solving challenges

The pressures facing shippers today come in two flavors. In retail markets, customers insist on fast convenience, meaning that shippers must offer a rapid and seamless omnichannel order-to-delivery process across the digital and physical buying experience. Specifically, the e-commerce landscape continues to get overhauled, with Amazon making strides in all spectrums of the supply chain, from logistics to forward stocking to same-day fulfillment. The expectation now set in terms of proximity and agility naturally spills over to other channels, too. If omnichannel is table stakes, companies must differentiate on *speed and innovation*.

Meanwhile, shippers in industrial markets, with increasingly complex operations, face global vagaries and rising volatility in key factors such as raw material costs, exchange rates, and tariffs. With strategic priorities in innovation and R&D, they tend to rely on third parties to help manage their logistics and supply chains efficiently.

For all shippers, talent and specialized insight can be hard to find, the right IT infrastructure may not be cost-effective or implementable, and an agile culture is often difficult to adopt. Thus, gaps between external requirements and internal capabilities are increasingly being fulfilled by third-party logistics providers (3PLs). Retail shippers want 3PLs to deliver speed and innovation in nontraditional service lines, and industrial shippers want 3PLs to deliver a seamless and cost-effective supply chain. In both flavors, 3PLs are expected to rise above operational support activities to a strategic role that's expected to have a steadily increasing demand (see figure 28), specifically in the domestic transportation and value-added warehousing segments.

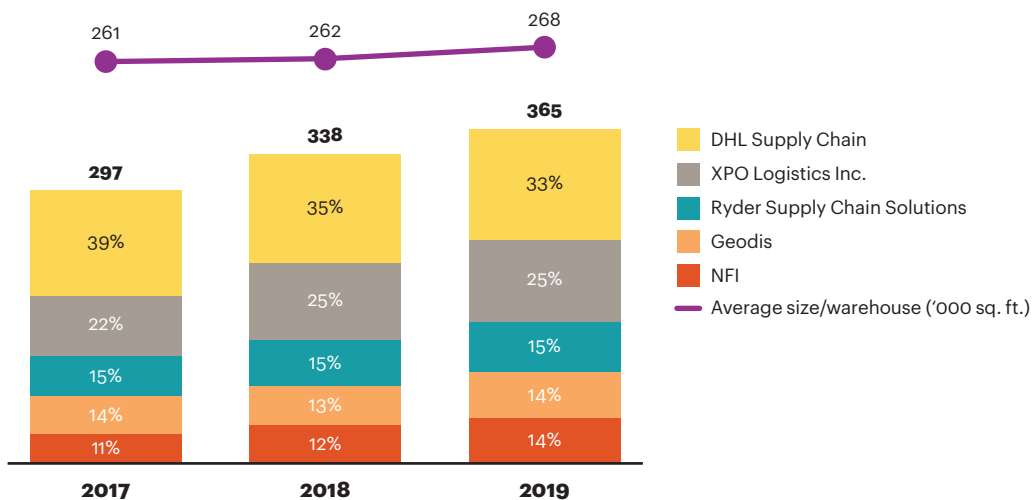
Figure 28
The demand for third-party logistics providers is expected to grow



Sources: A&A Global 3PL Market Report 2017; A.T. Kearney analysis

A *strategic role* naturally places increased importance on efficiently executing *critical processes*: retaining and increasing capacity; helping shippers implement dynamic inventory management to keep the right assortments available; staying close to customers through forward stocking locations; adding value through services such as assembly, packaging, and returns; and most famously, solving the last-mile delivery challenge. (While much recent attention has focused on *last-yard* delivery options—from Uber to lockers to drones—even those potential solutions rely on a *last-mile* delivery challenge to get a package within reach of a last-yard operator.) Specifically on stocking and warehousing, most 3PLs thus continue to remain bullish, with companies such as XPO and NFI heavily increasing their capacities since 2017 (see figure 29). Because 3PLs have traditionally thrived on their knowledge of processes, this increased process importance bodes well for their continued relevance. The challenge, as Greg Christensen, global logistics procurement director at Intel puts it, is that “3PLs need to come to us with proposals on the kind of automation and IoT solutions that are going to noticeably counter rising costs while increasing visibility. We hear of solutions in R&D labs but we do not see the case studies of success stories implemented at scale. Nobody wants to be the guinea pig.”

Figure 29
The warehouse footprint of top 3PLs is expanding



Notes: 3PL is third-party logistics provider. Numbers may not resolve due to rounding.
 Sources: <https://www.ttnews.com/top50/warehousing>; A.T. Kearney analysis

Rising demand and higher expectations from shippers increase the pressure on 3PLs to actually solve these challenges. How do you optimize logistics operations? How do you introduce technology innovations that shippers recognize as valuable? The answer lies in a work in process from an all-encompassing technological transformation under way. For example, XPO Logistics recently ordered 5,000 robots to be integrated with mobile storage racks and fulfillment stations into a modular goods-to-person system that will ensure speed and accuracy in picking, packing, and sortation. This system will complement XPO’s shared-space distribution model (XPO Direct) and further empower its fully automated digital freight marketplace (XPO Connect). In another example, DHL has embraced artificial intelligence to develop capabilities including prediction of global trade prospects (Global Trade Barometer) and supply continuity risks (Resilience360), as well as voice-based tracking services for last-mile deliveries. DHL also in 2018 rolled out a global augmented reality program, wherein pickers are equipped with smart

glasses to enhance their natural abilities in sorting, picking, placements, etc., offering cost and speed advantages. These are a few examples from the many traditional 3PLs that are embracing technology to lower costs, reduce the risk of labor shortages, and improve process efficiency. The shippers that pay the bills will be the arbiters of which solutions come to the fore.

Any industry in which technology could solve intense operational challenges will attract newcomers with a different business model. Consider these examples of three companies operating in 3PL domains:

- MXD Group, a last-mile fulfillment specialist, uses a proprietary order management system and visibility technology, featuring real-time tracking and a customer service portal.
- AFN Logistics, a manufacturer-focused brokerage, uses predictive analytics and machine learning to help logistics managers drive improvements in process and resource allocation.
- CaseStack, a non-asset-based logistics platform, offers collaborative consolidation programs and technology-enabled truck brokerage focused on LTL.

The story of nontraditional, technology-driven companies disrupting third-party logistics markets is here to stay. If the incumbents can't buy them out, they will at least need to learn to work alongside them.

In each example, a company with a proprietary technological solution had sufficient cost and quality advantage to carve away a piece of 3PL business. The eventual outcomes were not surprising: MXD Group was acquired by Ryder System for \$120 million, AFN Logistics by GlobalTranz for \$140 million, and CaseStack by the Hub Group for \$255 million, all in mid-to-late 2018. Nevertheless, the story of nontraditional, technology-driven companies disrupting 3PL markets is here to stay. If the incumbents can't buy them out, they will at least need to learn to work alongside them.

As for shippers, will they continue their relationships with traditional 3PLs rather than going directly to a tech-savvy start-up? A shipper may consider outsourcing these services piecemeal if two conditions are present. First, it needs enough understanding of the value chain to see how these individual pieces would come together. (As noted above, shippers may not see this as a strategic priority.) Second, it will see traditional 3PL firms as inadequate. Sadly, mistrust has characterized many shipper-3PL relationships. Both parties have tended to see their interactions as a transactional necessity rather than a long-term partnership to establish a winning position. Strategic partnerships have always promised intriguing potential, a nirvana that some players might someday ascend to. Looking forward, there's no reason that such a nirvana couldn't involve three-way partnerships among a shipper, knowledgeable 3PL, and tech-savvy start-up. Yet given the sector's history, competition rather than cooperation is the more likely path.

Warehousing: go big and go small

Driven by cost-concerned shippers

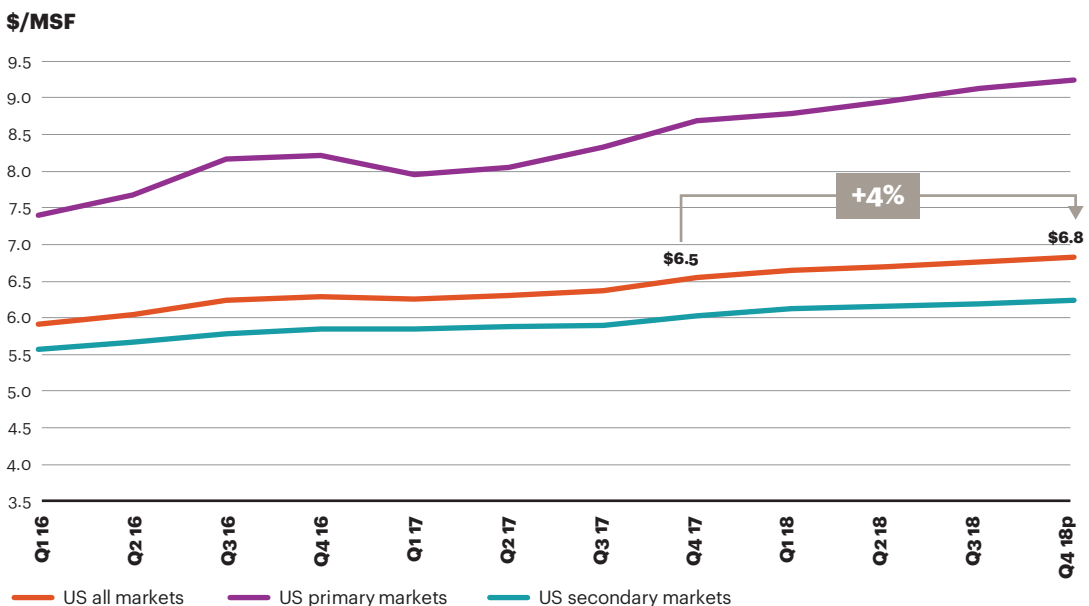
The US warehousing market in 2019 will be similar to the past few years, with record-low vacancy rates, increasing rents, and steady onboarding of new warehouse and distribution space, with demand still always exceeding supply. Choosing the right warehousing/distribution locations remains an essential strategy for shippers seeking to manage rising logistics costs amid increasing demand for speedy deliveries.

In 2018, warehouse rents nationwide increased roughly 4 percent, to \$6.80 per square foot, a slower increase than in the past six years (see figure 30). We can expect this trend to continue. With stable rent increases, warehouse developers are adding to supply, although not yet robustly enough to meet increasing demand. Driven by imports and e-commerce, rent growth will be strongest in port markets and submarkets of populated inland distribution hubs such as Dallas and Chicago. With limited options, tenants will initiate lease renewals more quickly, and sign for longer terms. Thirteen primary markets—including Atlanta, New Jersey, Chicago, and Dallas/Fort Worth—continue to have acute shortages of space. On the other hand, the need for modernized warehousing space is poised to accelerate growth in secondary markets such as Baltimore, Kansas City, and Indianapolis.

Warehouse developers are still bullish in the top industrial markets, given the low vacancy rates and high demand for quality space. A majority of the top 10 markets (based on 2018 deliveries) moved upward in square feet delivered from 2017 to 2018.

On the labor side—50 percent or more of warehouse operating costs—warehouse workers remain difficult to find, and expensive. According to the Bureau of Labor Statistics (BLS), the average employment cost index for logistics workers rose 3.5 percent in 2018; the index continued to rise

Figure 30
Warehouse rents increased in 2018, but at a slower pace than the previous six years



Note: MSF is million square feet.

Sources: Cushman & Wakefield; A.T. Kearney analysis

more quickly for logistics workers than for all civilian workers, as it has since 2016. Yet demand for labor will only increase. According to CBRE, US warehouses and distribution centers need an additional 452,000 workers in total by 2020. Warehouses could respond to the labor crisis by raising salaries, and we do expect wages and amenities to grow. Another approach is to replace labor with automation, especially in picking operations, as the latest technology innovations from start-ups such as Ocado, Mujin, and others are raising the bar from partial automation to total automation.

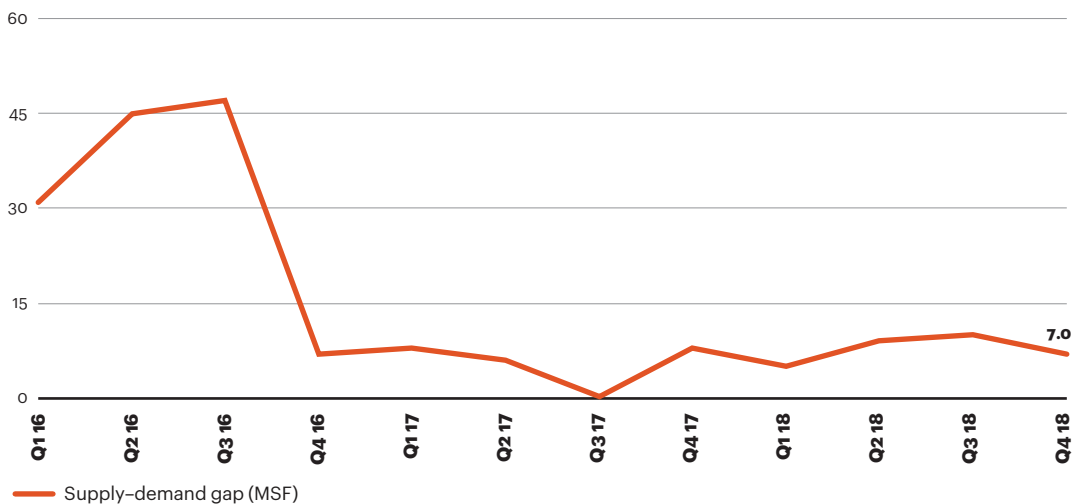
Availability of US warehousing space was particularly challenged in late 2018 and early 2019 by inventory buildups related to concerns over trade wars. Tensions eased with the US-Mexico-Canada Agreement (USMCA), signed November 30, 2018, and the US-China 90-day ceasefire a few days later. Although uncertainty continues to cloud the trade picture, even if a US-China trade war does emerge, substitute products will likely come from other Asian countries to US ports and gateway warehouses.

Trends in capacity and location

Although the supply of warehousing space is growing—by 56.6 million square feet in the fourth quarter of 2018—demand is growing faster. (Expressed in industry measures, the *net absorption rate*—which measures demand for vacated space as well as new additions—exceeded new builds in Q4 2018 by more than 11 percent.) The available capacity continues to be tight; for example, the supply-demand gap was 7 million square feet in Q4 2018 (see figure 31).

Figure 31

Warehousing space demand continues to outpace supply



Note: MSF is million square feet.

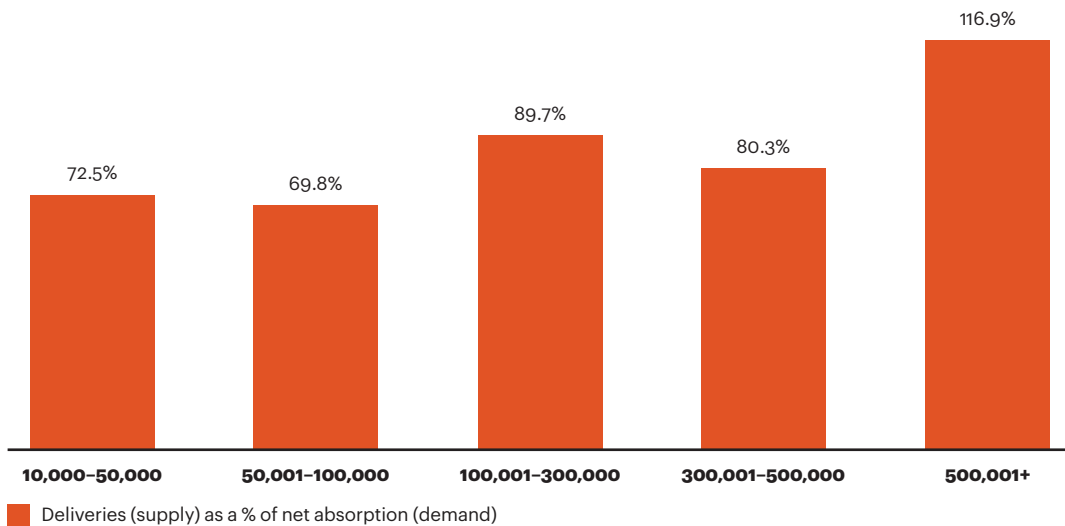
Sources: CBRE Q4 Industrial & Logistics report; A.T. Kearney analysis

Within that demand, e-commerce creates unusual spikes in the size and location of warehouse space desired. Due to their greater variety of products and the promise of expedited delivery to customers, e-retailers typically require three times the capacity of the average buyer of warehouse space, so demand is expected to be strong for warehouses larger than 300,000 square feet. Warehouse deliveries covered only 80 percent demand in the 300,000 to 500,000

square feet band (see figure 32). The ever-tightening service level window is also driving demand for smaller, urban warehouses, in the range of 10,000 to 100,000 square feet, where supply is even tighter as new warehouse builds lag demand. These spikes present a supply-side problem as on-demand warehouse operators must identify non-peak excess capacity strategies.

Figure 32

Supply of warehouse space smaller than 500,000 square feet cannot keep up with demand



Sources: Cushman & Wakefield; A.T. Kearney analysis

These small, close-to-consumer warehouses use *eaches* fulfillment processes that differ dramatically from *pallet* fulfillment processes—so much so that trying to combine them in a large regional facility may actually create dis-synergies. Urban warehouses also offer the advantage of a larger supply of labor. Thus, we can expect demand in this sub-sector to continue to grow.

Some warehouse builders are responding creatively. For example, Goldman Sachs and developer Dov Hertz recently teamed up to create a three-story, 370,000 square-foot warehouse in the heart of Brooklyn. Set to open later this year, the facility will feature 53-foot truck ramps providing unloading/loading access on the second floor as well as a forklift elevator to the third level. Similar facilities are being developed in Seattle, San Francisco, and Washington, DC. Given that vertical warehouses cost roughly twice as much to build as horizontal warehouses, in addition to the high cost of urban real estate, we should quickly see whether investors double down or back off such investments in the face of high urban demand for speedy delivery.

Some companies are seeking to achieve urban distribution by converting existing brick-and-mortar retail locations into fulfillment centers. For example, Albertson’s has begun transitioning sales floorspace to warehousing space in one out of every ~25 of its grocery locations. By assigning up to 10,000 square feet of floorspace for the fulfillment of same-day orders, the grocer is able to quickly pick *fast-runners* in the back while store employees collect *slow-runners* from the store shelves in front.

Tight capacity is leading to the development of warehouse on-demand brokering platforms, which give companies the ability to buy and sell excess warehouse capacity. Some platforms are further increasing their urban portfolios through the leasing of parking lots, local shop stockrooms, or even office building basements. STORD, the pioneer of the networked distribution model, has adapted to the changing demand by enabling customers to stand up new facilities in as little as two days. Other players such as Flexe, Ware2go, and FlowSpace have developed platforms to help connect shippers' warehousing needs with 3PLs that have space available for immediate use. Several large retailers and e-commerce start-ups are already working with them. Flexible, pop-up, public, and traded warehouse space will continue to grow in coming years as the benefits such as short implementation lead times and business flexibility attract more customers.

Technology trends

Pressure on operational efficiency, rising labor costs, and changing consumer expectations are accelerating the use of warehouse automation technologies. Many emerging technologies are not just theoretical concepts any more as they're being rapidly tested via pilots through partnerships between industry and technology start-ups. These pilots are most common in e-commerce fulfillment (for example grocery delivery), accelerated by pressures to compete with Amazon.

Owners and operators must adopt a holistic assessment framework prior to market scoping, vendor screening, and technology selection. Importantly, automation isn't a wall-to-wall one-stop solution. Instead it's an approach for addressing needs in various areas of a warehouse. For example:

- **Improved storage.** Automated storage and retrieval systems (ASRS) originated in the 1960s as cranes and racks for heavy-pallet loads but have since evolved to serve high-value products and now everyday goods as well. The variability of e-commerce demand across a large product portfolio increases the attractiveness of ASRS solutions such as Swisslog, Dematic, and Invata. Dematic offers a wide range of ASRS solutions and one of its recent implementation cases includes a Caterpillar distribution center (DC) in Illinois. Invata also has a strong presence within this space and recently supported Destination Maternity on the development of its new omnichannel fulfillment DC including the installation of a high speed shuttle.
- **Increased picking efficiency.** *Vision picking* systems, such as Ubimax XPick, use Vuzix and other *smart glasses* to display instructions to the warehouse picker, offering hands-free productivity improvements and eliminating paperwork. The Ubimax vision pick has been implemented in multiple companies in a wide range of industries, including DHL, Volkswagen, and Intel. Meanwhile, Ocado's *goods-to-human* method eliminates pickers' need to walk to shelves by having robots deliver the shelves to the pickers. Recently Ocado and Kroger announced a partnership to develop a customer fulfillment center in Monroe, Ohio.
- **Goods transportation optimization.** When it comes to moving goods, autonomous mobile robots (AMRs), such as those from Takeoff Technologies and Fetch Robotics, speed transit times while minimizing forklift issues. The adoption of AMRs is now at an inflection point as companies are starting to deploy them in their warehouses. Honeywell recently announced a partnership with Fetch Robotics to pilot the use of AMRs for supporting e-commerce fulfillments. Further advances are being made by start-ups such as Kindred.ai and Covariant.ai, which improve robot skills such as picking.

To orchestrate automation hardware, warehouses need to invest in the systems that manage and control this complex and growing wired environment. All the new robots must have platforms that talk to each other. Increased focus on warehouse automation and management

of robotics is driving greater need for a warehouse control system (WCS)—the material handling subsystem—and a warehouse execution system (WES)—the equivalent of a manufacturing execution system—as against using only the traditional warehouse management system (WMS). Both WCS and WES must interface efficiently with WMS to serve as the warehouse brain and direct robot muscles. This is changing the WMS landscape and the new rules of warehouse automation have significantly impacted WMS software providers. Most WMS providers have struggled with automated picking or e-commerce order processing, spurring WCS providers to develop rapid solutions that are able to address these issues (through order streaming logic) and connect to material handling equipment on the floor to manage order fulfillment.

There are multiple implementation factors to be considered, including:

- With multiple emerging solutions and no one-size-fits-all technology, companies must carefully identify the right partner and the right solution. The right technology solution is driven by a specific set of root problems identified through a formalized process and enabled through a right mindset.
- Financial viability and trade-offs must be carefully compared, and lessons about efficiency/improvement opportunities must be learned from prior implementations.

It is clear that warehouse automation decreases operational costs, maintains high service levels, unlocks higher levels of volume flexibility for omnichannel fulfillment, reduces exposure to labor force scarcity, and potentially provides a sustainable business advantage. However, automation is no silver bullet. To succeed, a business still needs integrated business planning including functional coordination and accurate sales forecasts. Rapid prototyping and enhancements as well as a clear road map to benefits are essential to enable the path to profitability in any automation initiative.

Blockchain: waiting for a leap of faith

Millions of dollars have been invested in blockchain over the past few years, and millions more are expected. Despite these investments—and the hype that has existed since its launch—blockchain technology has yet to take off. Many people believe that blockchain will soon transform industries such as finance and logistics. But blockchain today is like the 1990s Internet: although it offers hope, relentless hype obscures what it promises, what various players should do next, and how assorted risks, obstacles, and limitations could slow such progress.

A seamless transport network

The promise of blockchain technology is that a fully transparent transaction ledger could drastically improve data transparency and data sharing, thus overcoming some of the greatest inefficiencies in logistics today. A blockchain-powered network could seamlessly show where goods came from (addressing provenance and authenticity issues), where they were going (improving payments and border crossings), and where they are now (providing real-time tracking). Because it would be instantaneous and immutable, it would be more trustworthy than today's blizzard of processes and paperwork. Because it would be distributed, it would reduce the risk of a central point of failure. Despite these clear benefits, logistics and transportation companies have been slow to adopt this technology. The reasons are many, but perhaps most important is the need for a robust network of companies willing and able to adapt.

The blockchain isn't magic beans. A meaningful blockchain ledger needs to be accessible to and used by all players—shippers, carriers, and regulators; and companies large and small. Like other networks (the best example being a social network), it's only valuable at a scale where everyone is participating; until everyone agrees to participate, no single entity will gain much benefit.

So how does this network develop? Who takes the lead? Will large companies be willing to decentralize? Will smaller players see sufficient benefit to join up? How can the industry get competitors to work together to build a truly universal network?

Early stages and measures of success

Blockchain in logistics is still in an early stage and answering the first of four questions that will drive its evolution to a more advanced stage:

1. How do we make sure we have interoperability of existing data—can we settle on *common standards*?
2. How do we create more electronic data to live on the blockchain—can we *digitize*?
3. How do we eliminate human touchpoints and data entry to avoid inadvertent errors—can we integrate the blockchain with sensors and networks often summarized as the *Internet of Things*?
4. How do we automate the decisions made with all this information—can we achieve the holy grail of integrating the blockchain with *artificial intelligence*?

The questions demonstrate the promise. Each question should be answerable, and each answer can produce huge efficiencies in shipping. Getting to the answers, however, will require work. Thus, even if many companies jump on the bandwagon of acknowledging blockchain's potential, that can't be a measure of success. Instead, the way to measure success is through actual examples of successful, real-life pilot projects.

Ways to use blockchain

A company that is considering improvements to its supply chain shouldn't swing for the fences by trying to develop an internal cryptocurrency or impose on trading partners a self-executing smart contract. Blockchain is merely the technology; the solution comes from building a network. Thus, you want to carefully develop use cases for tactical pilot projects that will incorporate blockchain technology with already-trusted partners. Examples might include complying with electronic data interchange (EDI) standards such as GS1, asset tracking, illicit trade detection, recalls, and checks on data quality and consistency.

We'll discuss existing initiatives below, but broadly, blockchain technology could be used to enable greater innovation in transportation and logistics. For example, an airline could develop a blockchain-based airline loyalty digital wallet, or could use blockchain technology for supply chain transactions, delivering a purchase order from its origin to the final destination. A railroad could use blockchain standards in such areas as vehicle maintenance, quality control, and fraud prevention. Ocean carriers could use distributed ledger technology to improve efficiency: improve shipment visibility, eliminate paperwork, reduce errors, and shorten transit and clearance times. Other logistics players could use blockchain to digitize and secure supply chain and logistics processes; improve order accuracy; and track physical assets such as vehicles, trailers, and trucks.

Overcoming obstacles

As noted above, unlocking the network benefits of blockchain requires wide participation. The participation challenge takes two forms: making the blockchain solution attractive to a wide variety of participants and ensuring appropriate confidentiality for each participant. Companies may be reluctant to share, for example, volumes of goods being shipped, if that data will be available to companies in similar markets. Any private solution risks conflicts of interest—why should other parties trust the company that set up the blockchain? Blockchain hype talks about overcoming mistrust—but that very mistrust poses major hurdles to achieving a blockchain solution because each participant must both drop its old network and make a leap of faith to trust the new one.

For example, consider TradeLens, a multi-stakeholder ecosystem jointly developed by Maersk and IBM. Maersk is at the forefront of pioneering the use of blockchain in the industry, and TradeLens—centered on a distributed ledger technology platform where shippers, 3PLs, carriers, and freight forwarders can share supply chain data—is a major achievement that gives it first-mover advantage. To date, Maersk has been able to convince more than 100 industry participants to join TradeLens, including global ports and customs authorities, cargo owners, and freight forwarding and logistics companies. But until the May 2019 commitments from CMA CGM and MSC, it struggled to attract carriers. Carriers that compete with Maersk were concerned about confidentiality given Maersk's role in the development of the platform—indeed, Maersk's ownership of the intellectual property. Without carriers, TradeLens' value proposition would be reduced. The platform is most valuable only when cargo and inventory can be managed across the entire shipping ecosystem, and most large shippers use multiple carriers and freight forwarders. In short, Maersk has admirably solved the first participation challenge, attracting the wide variety of participants, but is still working on the second one, easing its competitors' fears about confidentiality.

Maersk has admirably solved the first TradeLens challenge, but is still working on the second one: easing competitors' confidentiality fears.

By contrast, the IBM-powered Food Trust blockchain platform has focused on getting competing firms to join. Food Trust allows food retailers and suppliers to track and trace food through the commercial food chain, thus helping to tackle an important problem. It can rapidly pinpoint "faulty" produce and remove the tainted goods from circulation without forcing retailers to dispose of every item in the affected food category. Although the high 2018 profile of food safety likely contributed to Food Trust's popularity, another factor is the way that IBM asked competitors what they wanted regarding data privacy and access when it developed the platform—to some extent, fears about conflicts of interest can be quelled by using applications and algorithms that provide confidentiality. The Food Trust Governance Committee has also helped reassure competitors of a level playing field. Of course, the Food Trust platform is more narrowly focused than TradeLens—it has done admirable work on the second challenge but may still face difficulties on the first.

The participation challenges highlight a tension between *private* and *public* blockchains. Private (or “permissioned”) blockchains are easier to implement because they involve limited, trustworthy participants. Conversely, public blockchain solutions may be better able to address confidentiality concerns. Organizations developing long-term public blockchain solutions include the Blockchain In Transport Alliance (BiTA), with 500 members in 25 countries; the Trace Alliance, which uses the OriginTrail protocol; and the Global Shipping Business Network (GSBN), supported by nine leading ocean carriers as an alternative to TradeLens.

Because the benefits of blockchain solutions are so network-dependent, one organization may eventually emerge as the leader. More importantly, behind the question of *which one(s)* lurks another open question: if, when, and how individual companies will decide to graduate from their private pilot projects to a public blockchain-based solution.

Path forward

So when will blockchain in logistics take off in full force? When will companies make the leap of faith to trust a network where control is decentralized across members and not completely in any one member’s hands? The answer lies in a combination of factors:

- Developing common standards for interoperability of data, such as GS1 standards for EDI, so as to prevent today’s physical supply chain barriers from becoming tomorrow’s digital barriers
- Ensuring confidentiality of member data, thus incentivizing more companies to join the network and increase its value
- Arriving at a tipping point in the blockchain network, when a sufficient number of early and mainstream adopters force the rest of the mainstream and late adopters to get on board or risk being left behind

5G: setting the standard for logistics

The 5G mobile broadband and communication standard will provide astounding improvements over 4G networks: it will be so fast that you can download 20 videos in the time it takes for one today; it will be so efficient with network energy that your sensors’ batteries will last 10 years instead of one; it will connect up to 1 million devices per square kilometer with 100 times more capacity than today, thus powering full-scale deployment of the Internet of Things (IoT). Although understanding how to invest in 5G requires a [nuanced view of its use cases](#), certainly 5G’s ultra-reliable and low latency capabilities will be essential for coming innovations such as autonomous vehicles, high-speed drones, and immersive augmented reality and virtual reality (AR/VR).

5G also offers tremendous promise to the logistics industry—for example through warehouse picking and packing via remote robotic control; real-time connectivity among vehicles, diagnostics, and maintenance using smart cities applications; and fleet management with improved telematics systems. But this promise will play out over years, across many functions, resulting from many choices that companies make about how to deploy the technology. To take advantage—and perhaps start thinking about how to change future business models—savvy players will need to understand its implications early.

Faster, cheaper, denser

Huge improvements in transfer speeds, latency (“time to ping”), device density, and power consumption will offer substantial business advantages. For example, today bandwidth arrives in a single, giant pipe, regardless of whether it’s powering a computer or a phone or a tiny

sensor. With 5G *network slicing*, you can slice bandwidth into a series of smaller pipes with different performance parameters for different purposes. Thus, the possibilities of technology expand dramatically, because the need for ultra-reliable connectivity for an autonomous vehicle can be segregated from the low-data needs of thousands of motion sensors.

Initial commercial deployments will likely take advantage of 5G’s enhanced mobile broadband—improvements in speed, capacity, latency, and so on. With 5G, the low-hanging fruit include applications such as ultra-high-definition (4K) video, 3D video, and AR/VR capacity enhancement. In the medium term, 5G’s ability to connect so many devices in a small area will overcome current limits on area coverage and sensors density. With 5G, each parcel can have its own sensor tracking detailed data, such as humidity and temperature; each robot can employ dozens of sensors with continuous uplink to the cloud. Thus, companies will be better able to implement infrastructure monitoring, process automation, smart metering, and real-time fleet management. In the longer term, 5G’s reliability and latency advances will facilitate the seamless handoffs required by autonomous vehicles and factory automation. Better vehicle-to-vehicle and vehicle-to-infrastructure communications will improve safety and traffic flow, unlocking profound advances in efficiency.

Implications for logistics

With 5G technology, companies will more efficiently execute operations, increase real-time decision-making, and improve service delivery. Broadly, there are three functional categories of 5G use cases in logistics (see figure 33 for examples):

Figure 33
5G can improve logistics in three functional categories

Function	Near term (0–3 years)	Long term (3+ years)
Operations execution 1	<ul style="list-style-type: none"> • Visor or helmet computer with augmented reality (AR) • Virtual reality (VR) for warehouse planning • Assisted driving • Augmented driver dashboards • Real-time high-resolution vehicle video surveillance 	<ul style="list-style-type: none"> • Fully immersive AR and 3D color display with sensing to map people, objects, and places • Autonomous trucking with vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) responsiveness • Drone delivery for last mile • Unassisted robotic distribution centers and protocols • Cloud robotics for warehouse and transportation
Planning and management 2	<ul style="list-style-type: none"> • Multi-angle, high-resolution video streaming with smart analytics and alerts on premises • High-resolution or 3D video or haptic feedback with thermal and other sensors • Remote quality inspection and diagnostics • Predictive maintenance for crucial or high-value equipment based on analysis of data from sensors • Rule-based, distributed supply chain planning and resource management 	<ul style="list-style-type: none"> • Real-time equipment data and remote intervention • Workforce monitoring and extensive analytics using smart clothes, equipment, and wearables • 3D presence with remote diagnostics-and-fix • Connected traffic cloud and steering • Large sensor network for predictive maintenance and real-time alerts of machines and robots across the supply chain • AI-based, unassisted supply chain management with minimal human input
Additional services 3	<ul style="list-style-type: none"> • High-security encryption across supply chain • Cloud-based logistics tracking, intelligence, and orchestration services • Real-time location and video access for customers and logistics partners • Advanced metering infrastructure (AMI) and smart meters for mobile and stationary assets 	<ul style="list-style-type: none"> • Identification and tracking of goods across the end-to-end supply chain • Highly-customized logistics services (for example, climate-controlled parcels, trigger-based protocols) • Broadband to remote logistics nodes through FWA • Reduced energy consumption of sensor and use of smart grids and responsive assets

Sources: Ericsson The Industry Impact of 5G, Report ITU-R M.24 10-0 (Nov-17), A.T. Kearney analysis

1. **Operations execution.** 5G can improve delivery and yard management, goods preparation, transportation, claims handling, loading, and tendering—low-skill, repetitive, and execution-oriented functions involving daily business operations.
2. **Planning and management.** 5G can improve load planning, tendering and booking, carrier rate and contracts management, network design, data management, and data-based decision-making—planning and thought-driven functions that include strategy development, process scheduling, execution planning, and exception management.
3. **Additional services.** 5G can advance nascent services and provide ancillary functions beyond traditional logistics offerings—improved traffic data management, AI-based routing guide support, automated and predictive order adjustment, data security, and supply chain coordination across all nodes and stakeholders. These may also include sustainability-focused applications, such as those centered around energy usage, carbon output monitoring, and environmental impact.

In each category, specific use cases, and the degree of benefits they will bring, can be broken into near term (0–3 years) versus long term (3+ years, with greater deployment and maturity) (see figure 33 on page 50). Although the 4G LTE networking standard supports select use cases, most require the bandwidth, reliability, and latency that only 5G architecture can offer.

Which types of logistics companies will benefit from 5G? We can break them into the following categories:

1. **Asset-based carriers.** A trucking company, such as Ryder or Penske, or major shipping line that owns vessels, such as Maersk, will use 5G to track assets in real time, optimize their utilization, make decisions informed by detailed data not accessible before, and eventually move toward autonomous operations.
2. **Freight forwarders and brokers.** Companies with no or limited assets, such as Kuehne + Nagel, DSV, and DB Schenker, could increase visibility for planning and improve worker productivity. A smaller set of capex benefits are expected for these players than for asset-heavy companies, but elevated precision and more cost effectiveness are anticipated for a large portion of their execution functions. Additionally, offering new, high-value logistics services using 5G technologies and use cases could emerge.
3. **Warehousing providers and 3PLs.** Companies with limited assets and end-to-end logistics service providers will fall somewhere in between the two previous categories. Specialization in functions or areas of the value chain would become increasingly important to compete with growing efficiencies and new offerings of market leaders. Simply put, these players may choose to participate in fewer segments but become a lot more competitive in them.
4. **Logistics tech start-ups.** Companies focused on the software to achieve these functions—such as tracking assets, managing data, implementing artificial intelligence, or powering autonomous vehicles and systems—will use 5G to expand their capabilities and customer base. New forms of automation will also emerge, ranging from drones for last-mile delivery to robotic pallets for warehouse picking (see sidebar: The Race for Drone Delivery on page 52).
5. **Original equipment manufacturers (OEMs).** Truck manufacturing companies; maintenance, repair, and operating (MRO) suppliers; device makers; warehousing equipment manufacturers; and other such contributors to logistics operations will use 5G to create new products with new functionalities, incorporate additional capabilities into existing products, and upgrade existing ones to be compatible with these new, smart systems.

Sidebar: The Race for Drone Delivery

With the upcoming launch of 5G, scaling drone deliveries is top of mind. UPS began the first authorized use of unmanned drones to transport packages—its “quadcopter” drones carry medical payloads of five pounds for distances up to 12.5 miles at WakeMed hospital campus in North Carolina. Drones are expected to soon be delivering airplane parts for FedEx at Memphis International Airport, as well as inspecting its planes, runways, and hard-to-reach infrastructure.

As part of a far-reaching test program to better understand drone delivery, the Department of Transportation approved 10 state and local governments to partner with cutting-edge companies such as Intel, Uber, and Qualcomm to test social and technological aspects of drone commerce.

Other groundbreaking approvals include Wing Aviation, Google’s subsidiary, becoming the first drone operator to get Federal Aviation Administration approval

as an airline, giving it legal authority to transport products to paying customers.

Though Google Wing beat Amazon to FAA approval, Amazon’s ambitious Prime Air program aims to use drones to deliver Amazon orders to customers’ doorsteps within 30 minutes or less—leaving the winner in the race for drone delivery still to be determined.

Key trends

The 5G rollout will lead to the following key trends across the logistics value chain:

- 1. Improved business-as-usual.** Operations requiring low skill levels and limited decision-making will be early targets for 5G applications—and will achieve cost reductions within a short term. Because they can be modularly deployed from commercial vendors with few technological complications or changes in operating models, applications such as video monitoring and AR-based productivity tools will be among the first success stories. With lower latency and hyper-connectivity in the logistics ecosystem (for example, between fleet and warehouses), 5G will boost several process execution activities as noted in figure 33 above. For example, imagine a yard management system connected to sensors on pallets or on products in the warehouse and in trailers. The system receives a live feed on order status with detailed data, like a continuous “health check,” using it to optimize the movement of trucks and trailers in real time or re-order inventory damaged in transit.
- 2. Early adopters in last-mile shipping.** The growing demand for faster delivery and greater visibility into shipment tracking continues to compress margins for transportation providers and for retailers. Thus there is a clear case for early investment in 5G-powered technology that will help meet these growing consumer expectations. 5G will enable ground-breaking methods of quick, cost-effective delivery—examples are air and land drone delivery at scale and real-time brokerage services to connect demand with supply for services or personnel. 5G promises to enable more visibility and control over transportation systems—true real-time tracking of product movement in the journey from factory to consumer, which will lead to better customer experience. We believe the case for Control Tower 2.0. is imminent.

- 3. Next frontier in productivity.** 5G will be a game changer, particularly in boosting warehouse and distribution center performance from automation. Replacing wired networks with 5G connectivity will make a huge difference. Many warehouses piloting automation, robotics, and IoT devices rely on wired systems that aren't well coordinated or flexible. 5G connectivity will also improve the performance of robots that currently follow inflexible warehouse paths, which can be made more precise with 5G. For drivers, productivity will improve with better traffic-light adaption, assisted driving, integrated AR dashboard tools, and electronic logging device (ELD)-based real-time management, resulting in faster, more efficient, and safer routing. Communications companies, especially wireless carriers, are already beginning to leverage 5G and IoT solutions in their own supply chains to improve operational effectiveness and efficiency but also to showcase these capabilities to potential enterprise customers and other IoT ecosystem participants. Sprint, a machine-to-machine (M2M) and IoT pioneer, recently announced a connected logistics lab within its main distribution center for these very purposes. Initial focus areas for Sprint and its partners in industry and academia are asset tracking from OEM to base station (allowing for predictive cash flow management, equipment staging, workforce planning and performance management, and even proactive regional marketing), autonomous forklifts, and drone technology (in warehouse for physical counts).
- 4. Emerging revenue opportunities.** With 5G, logistics players will invent additional sources of revenue and high-end service offerings. These may include real-time supply chain orchestration with complete visibility from manufacturing to store shelves, cloud-based logistics services, video analytics capturing real-time full-time video of products being shipped, custom climate-control solutions, blockchain security encryption, enhanced fleet-telematics capabilities, and AI-based operations planning.
- 5. Vertical integration of service providers.** Because new cutting-edge use cases will often extend into adjacent value chain segments, many players will seek to capture ecosystem synergies and incremental revenues by expanding their offerings beyond traditional segments. For example, a long-haul trucking company with strong data and 5G capabilities might decide to use drones or autonomous vehicles to enter the last-mile delivery segment.
- 6. End-to-end view of the supply chain.** The eventual spread of 5G and anticipated large appetite for adoption will lead to many ecosystem entrants with thousands of applications in this space—finally creating the opportunity for an end-to-end view of the entire supply chain. With the large, inflexible ERP systems of the past, it would have been cost-prohibitive to instrument an entire supply chain, if such a task were even possible. Connecting all elements of the supply chain would be laudable but impossible. But because 5G offers the ability to more flexibly connect all elements and providers throughout the supply chain, this vision can finally become a reality.

Logistics Trends and Outlook: Sustenance Requires Innovation

Innovation is driven by evolving customer needs, by inventors who spot opportunity, and by desire for financial gain. While this truth drives the trends we see in the logistics industry, there is another reason for the adoption of new technology: sustenance. Simply put, operators need to innovate to sustain, to disrupt themselves, or else be disrupted. For example, labor shortages across various modes are leading to a renewed focus on productivity through the adoption of machine learning-based tools that improve utilization and employee satisfaction, as we are seeing in the trucking industry with technology-driven solutions to improve asset utilization and driver retention. Taking this further, a more radical strategy is to disintermediate the human through automation and robotics, as we are seeing in freight brokerages, warehousing, ports, and even in last-mile logistics. A different angle on sustenance is the changing regulatory environment spurred by the need to rein in pollution and climate change to sustain our planet. For example, IMO 2020 regulations will require ocean carriers, which serve 80 percent of global trade, to develop cleaner fuels or carbon sequestration technology. Compounding these innovation drivers, the face of global commerce is rapidly evolving and leaving a profound impact on the logistics industry (see sidebar: Market Spotlight on Amazon's Multiple Transportation Initiatives on page 55).

Labor shortages across various modes are leading to a renewed focus on productivity through the adoption of machine learning-based tools that improve utilization and employee satisfaction.

Growing demand for online shopping for everything from groceries to mattresses is requiring big investments in supply chains that must be nimble and flexible in new ways.

If sustenance requires innovation and innovation requires technology, then investments are essential (see sidebar: Technology Spotlight on Tesla's Semi on page 56). Indeed, operators are coping with rapidly evolving and strengthening drivers of change by adopting and investing in many new technologies (see figure 34 on page 57). Aiding in the adoption of these technologies is Silicon Valley, with its upstart entrepreneurs seizing on the next big opportunity to serve a trillion-dollar industry. Indeed, much of the technological disruption we are witnessing today is emanating from the Valley.

Clearly, all these technologies have an impact on the logistics value chain in some form, but the timing of their fruition is still uncertain, as their development is neither consistent nor linear. Companies investing in technologies can resemble NBA teams investing in second-round draft choices: even the best options are continually "two years away" from

Sidebar: Market Spotlight on Amazon’s Multiple Transportation Initiatives






While Amazon has significantly expanded its capabilities in multiple modes of transportation and logistics, 2019 marks the first year that Amazon added “transportation and logistics services” to its group of competitors listed

in its 10-K annual filing. Amazon’s most notable developments have been in fulfillment solutions and in-house package delivery to top metro areas (see figure). These advances have and will continue to negatively impact delivery

densities and thus profitability of other last-mile carriers. While other initiatives expand Amazon’s capable modes of transportation, they are still in earlier levels of maturity and have yet to add sizeable capacity to the market.

Figure

Amazon’s transportation and logistics capabilities continue to expand

		Key observations
	Entered FTL freight brokerage at low to no margins	<ul style="list-style-type: none"> Released beta version freight.amazon.com platform in April 2019, providing instant full truckload (FTL) quotes for lanes in CT, NY, NJ, PA, and MD Operates at prices 26-33% below prevailing market prices and DAT contract rates (source: FreightWaves) Expands Amazon’s FTL network and purchasing power, and locks up capacity for peak season
	Setting the standard on shipping speed	<ul style="list-style-type: none"> Announced in April 2019 that delivery time on all Prime items will fall from 2-day to 1-day Will need to expand its 115 US delivery stations to an estimated 350-400 to support 1-day delivery in all markets with populations of more than 100,000 (source: MWPVL)
	Increasing automated third-party fulfillment and logistics services	<ul style="list-style-type: none"> Built 25 fulfillment centers in 2018; total is now 139 fulfillment centers as of April 2019 47 fulfillment centers are capable of warehousing and fulfilling products from third-party sellers Robotics group developed 15,000 “drive” robots that automatically move portable inventory shelves; a total of 100,000 robotic systems are deployed across 25 automated centers
	Amazon Air rapidly expanding air freight	<ul style="list-style-type: none"> Adding a central sorting air hub in Cincinnati/Northern Kentucky by late 2021, bringing total active airports to 22 Fleet is projected to double from estimated 50 planes in December 2018 to 100 by 2027 Will expand 1-day network footprint, and allow consolidation of slower-moving inventory
	Amazon enters ocean freight to become sole end-to-end e-commerce provider	<ul style="list-style-type: none"> Received ocean freight non-vessel-operating common carrier (NVOCC) license in 2016 Shipped equivalent of 5,300 containers of consumer goods from China in 2018 Expanded ocean freight service from Chinese shippers only to US-based companies in 2018 Q4 Now capable of seamless solution from receiving inventory at a Chinese port to US delivery

Sources: FreightWaves, MWPVL; A.T. Kearney analysis

being ready to contribute. (And many are, as one basketball analyst famously put it, “two years away from being two years away.”)

How do you handicap them? To provide clues on which logistics use cases are trending, we tracked venture capital investment, new start-ups, general population interest, and media impressions (see figure 35 on page 57). Talk of blockchain in the logistics industry has exploded over the past two years with sharp increases in investment and the number of start-ups working in this space. Other disruptive technologies and business models such as autonomous trucking and Uberization of freight have slowed in momentum but are by no means out of the picture—they are entering a phase of maturity with several established start-ups working on readying the

Sidebar: Technology Spotlight on Tesla's Semi

As anticipated, release of the Tesla Semi battery-powered semi-trailer brought unprecedented performance numbers to Class 8. Superior to its diesel counterparts in many ways, Tesla rightfully hit the mark for a breakthrough product, at least on paper. Among its virtues are instantaneous and wide-band torque, lower energy and maintenance costs, semi-autonomous driving capabilities, and environmental friendliness (depending on the source of electricity).

All make promising selling points—but is the market that Tesla is seeking to transform truly ready to accommodate it? First, the market is extremely fragmented; owner-operators and companies with fleet sizes smaller than six are risk- and change-averse. For many years they tested Freightliners and

Peterbilts and built confidence around trusted service networks that minimize the cost of their assets, a factor that often makes or breaks their thin operating margins. If Tesla's policy of prohibiting non-Tesla service centers continues for trucks, that may be a deterrent for buyers, because Tesla's OEM parts are not cheap. Tesla will need to either foster a non-OEM service network or offer trucker-worthy warranty coverage.

Second, the electrification infrastructure is inadequate—a factor that has also hindered electrification for traditional motor carriers. Range anxiety over battery capabilities is harder to overcome for trucks than passenger vehicles, because truckers log 10 times as many miles. For the owner-operator, recharge time can be partially

addressed with the extended range version (500 miles), but for fleets and team drivers, it will be an added complexity. Also, the fast-charge (30 minutes to 80 percent) will require a Tesla Megacharger—a network that is not yet widely available on the interstate highway system. We believe that fleet owners will be initial adopters, as evidenced by a recent Tesla statement claiming about 2,000 reservations from companies including UPS, Walmart, Pepsi, and Anheuser-Busch.

In summary, the Tesla Semi is a promising product, for a partially ready future of autonomous driving, which offers attractive fuel savings. Nonetheless, Tesla will need to take significant steps toward overcoming buyers' range and service network anxiety.

technology for prime time, in the case of autonomous trucking, and fine-tuning their value propositions, in the case of Uberization (see figure 36 on page 58).

Outlook for the industry

After the capacity crises of 2018, multiple signals indicate an easing of conditions in 2019. The global economy isn't growing as fast. Shippers are better prepared for tight conditions. Capacity supply will increase, especially in sectors such as warehousing, pipelines, and even trucking, despite the spate of Class 8 order cancellations by fleet owners in H1 of 2019. As the pace of innovation and investment quickens, and customer needs become more acute, technological tools should start accelerating the payoffs in efficiency gains.

While the global economic context remains volatile and uncertain, there is cause to believe that the industry will be better able to achieve equilibrium. Yes, a trade war could decimate volumes, or the economy could slow more than expected, but consumers could extend their insatiable demands from same-day to same-hour delivery. Nevertheless, trends suggest the following broad outlooks.

Figure 34

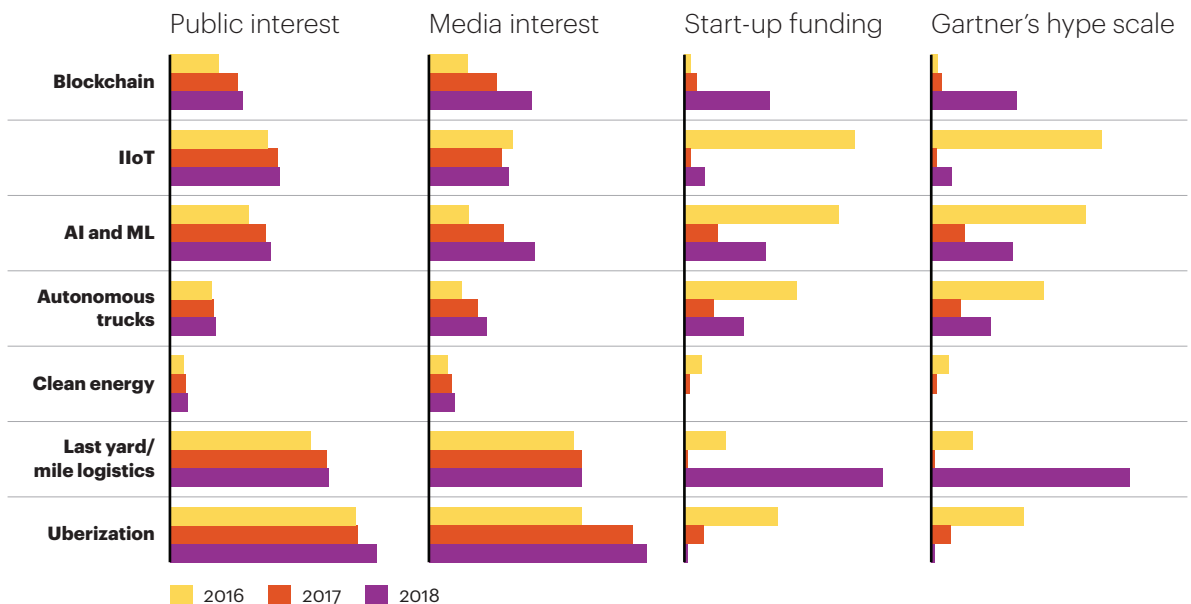
Logistics operators are investing in several new technologies

		Implications for logistics				
		Planning	Operations	Assets	Warehousing	Business model
Technological enablers	AI and ML	<ul style="list-style-type: none"> Routing Load-matching Booking 	<ul style="list-style-type: none"> Exception handling Automated gates 	<ul style="list-style-type: none"> Predictive maintenance Autonomous trucking 	<ul style="list-style-type: none"> Inventory positioning Forecasting 	<ul style="list-style-type: none"> Crowdsourcing On-demand Sharing economy Last mile/yard
	IIoT and 5G		<ul style="list-style-type: none"> Asset tracking Cargo provenance monitoring 	<ul style="list-style-type: none"> Predictive maintenance Autonomous trucking 	<ul style="list-style-type: none"> Track and trace 	<ul style="list-style-type: none"> Crowdsourcing On-demand Sharing economy Last mile/yard
	AR and VR		<ul style="list-style-type: none"> Training Maintenance 		<ul style="list-style-type: none"> Picking 	
	Robotics			<ul style="list-style-type: none"> Drones Sidewalk robots 	<ul style="list-style-type: none"> Drones Automated guided vehicles 	
	Blockchain		<ul style="list-style-type: none"> Document management Traceability 			
	Renewable energy			<ul style="list-style-type: none"> Electric trucks Hydrogen trucks 	<ul style="list-style-type: none"> Carbon neutral warehouses 	

Notes: AI is artificial intelligence. ML is machine learning. IIoT is Industrial Internet of Things. AR is augmented reality. VR is virtual reality.
 Source: A.T. Kearney analysis

Figure 35

A number of technologies have momentum in the logistics industry



Notes: IIoT is Industrial Internet of Things. AI is artificial intelligence. ML is machine learning.
 Sources: Google Trends, Pitchbook, Gartner; A.T. Kearney analysis

Figure 36

There have been a number of recent technological developments in logistics

Snapshot of recent developments	
Uberization	<ul style="list-style-type: none"> • Flexport launched OceanMatch, a platform that allows shippers to access empty space on ocean containers for LCL cargos. They also raised \$1 billion from SoftBank at a valuation of \$3.2 billion. • Uber revealed in its IPO filings that Uber Freight managed \$359 million in freight business through its Uber Freight platform in 2018. • Interestingly, Amazon’s Flex model of allowing independent couriers to deliver packages is pivoting into a “delivery service partner” model with contractors who manage small, dedicated fleets of couriers.
Last mile and last yard	<ul style="list-style-type: none"> • Move over last mile: according to The Third-Party Logistics Study by CSCMP, 70% of shippers and 3PLs recognize the need for “last yard logistics” from neighborhood locations to consumers’ doorsteps. • Following in the footsteps of Amazon Key, UPS launched a pilot with Latch to securely place parcels inside residences. • FedEx launched its SameDay Bot sidewalk delivery robot and is piloting it with Walmart, Target, AutoZone, Lowe’s, and Pizza Hut. The autonomous bot has 10 million hours of testing under its belt and can avoid pedestrians and obstacles, climb stairs, and is intended to carry cargo from FedEx Office locations to consumers. • Google became the first to receive approval from the FAA to operate as an airline and commercialize its drone delivery technology.
AI and ML	<ul style="list-style-type: none"> • DHL is using machine learning to predict delays in its air freight operations so that they and their customers can proactively mitigate them. • IBM Watson has developed a cognitive computer vision-based system to capture images of rail wagons to not only identify and classify potential damages but also prescribe corrective action with upward of 90% accuracy. • Israeli start-up package.ai has developed a conversational chatbot to support last-mile delivery by coordinating delivery times and locations with consignees and sending automated instructions to couriers.
Autonomous trucking	<ul style="list-style-type: none"> • Daimler trucks decided to suspend its truck platooning program as trials of the technology did not yield the anticipated benefits with regard to fuel savings and that the barriers to implementation did not justify continuation. • Several European truck manufacturers are still optimistic about project Ensemble, with the goal of public demonstration of platooning in 2021 with up to seven trucks from different OEMs. • Phantom Auto, a Silicon Valley start-up, believes that gamers could be the future of trucking’s perennial driver shortage problem. Currently they are piloting the remote operation of yard trucks from an operations center several states away. Volvo is also working on similar technology.
Blockchain	<ul style="list-style-type: none"> • IBM and Maersk’s TradeLens blockchain platform has 92 participating organizations and has captured 236 million shipping transactions. • Several leading logistics players, including CMA-CGM, COSCO, and DP World, have formed the Global Shipping Business Network (GSBN) consortium, an open digital platform based on blockchain technology.
Clean energy	<ul style="list-style-type: none"> • Nikola motor acquired 400 acres of land for the production of its hydrogen fuel-cell-powered electric Class 8 rig. US Xpress and Anheuser-Busch, who has already ordered several hundred of the big rigs, will begin fleet trials by the end of the year. • Toyota and Kenworth trucks announced at CES that they will develop a hydrogen-electric rig for drayage operations. • Tesla officially launched its much-awaited semi and is already using them to haul Tesla cars to new owners (see our spotlight on the semi). • Penske partnered with Daimler to test 20 electric trucks across a network of the US’ first 14 high-power electric charging stations.

Source: A.T. Kearney analysis

Growth. Trade tensions with China spurred shippers to pull forward inventory ahead of the January 1 deadline, leading to subdued 2019 growth expectations since a lot of inventory was already in place. Trade tensions also had the effect of stalling economic growth toward the end of 2018, and economists see that waning consumer confidence is slowing growth through 2019. One bright spot is the continued growth of e-commerce, which is leading to rising intermodal shipments and increasing emphasis on contract logistics for last-mile deliveries. Several retailers and real estate companies are investing in smaller-format warehouses closer to demand centers in urban areas. Whatever the GDP growth outlook, the logistics industry will be called on to further innovate, improve productivity, and deliver better services—and so investments will continue from operators that expect to emerge as winners.

Capacity. Several modes that saw capacity shortfalls in 2018—either artificially, as in the case of ocean, or due to real shortage of capacity, as is the case in trucking—are seeing demand pressure moderate in 2019. Despite this apparent short-term temptation to be opportunistic in rate negotiations, the goal for shippers should be to actively manage and nurture relationships with carriers. This means co-developing long-term goals while in the short term communicating delays in advance, honoring load commitments and pickup/delivery windows, and aiding carriers in their pursuit of optimizing asset utilization. On the warehousing front, the inventory buildup that constrained capacity is going to reverse as tariffs lower import growth, but long-term growth will keep shippers looking for reliable capacity.

Geopolitical forces. Signals are volatile and conflicting on the path forward in trade relations, with US-China, US-Mexico, and US-Europe all flaring regularly, so we can only observe their short-term negative impact on logistics demand going forward, as shippers anticipate shrinking demand for tariff-hit products and carriers brace for severe effects on modes such as rail and trucking. The recent withdrawal of waivers to several countries permitted to import Iranian crude, in an attempt to tighten sanctions on Iran, are likely to bring renewed volatility to fuel costs. With rising output from the Permian Basin, the US is slated to become a net exporter of oil this year, with China appearing to be one of the biggest customers, redrawing global supply chains in the process.

Regulation. Global attention to the climate challenge has spurred both public- and private-sector action in reducing our carbon footprint. IMO 2020, set to go into effect on January 1 of next year, mandates that ocean carriers, which contribute 3 percent of global emissions, reduce their emissions through newer technology or cleaner fuels, increasing the cost of shipping goods around the globe. Furthermore, changing domestic consumption patterns are resulting in a projected decrease of coal-generated power from 28 percent to 24 percent, with the deficit being picked up by natural gas and renewables.

In sum, key forces are at play in an ever-changing business environment with geopolitical surprises always seeming imminent. While the logistics industry will always strive to increase efficiency and cut costs, it is worthwhile for shippers and carriers to think about how they will work together to adapt to rapidly changing conditions and build innovation, flexibility, productivity, and sustainability into their operations.

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Appendix

Estimating USBLC

The CSCMP and A.T. 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 62 and 63).

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
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 and ports	<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

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

Inventory carrying costs		
Storage		<ul style="list-style-type: none"> • BEA input-output accounts, annual, production of commodities by industry • Armstrong & Associates, total US warehouse market
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"> • A.T. 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: A.T. Kearney analysis

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 2009 using current sources and methodologies (see figure B on page 64). 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	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Nominal GDP	\$ billion	14,448.9	14,992.1	15,542.6	16,197.0	16,784.9	17,521.7	18,219.3	18,707.2	19,485.4	20,500.6
Total business inventory	\$ billion	1,929.0	2,015.8	2,247.4	2,337.9	2,395.4	2,524.4	2,513.8	2,527.6	2,628.6	2,750.2
Inventory carrying rate	%	19.3%	18.5%	17.7%	17.5%	17.8%	16.2%	17.0%	16.3%	16.4%	18.0%
Transportation costs	\$ billion	622.7	681.9	749.3	785.8	809.9	903.4	907.0	904.2	939.9	1037.4
Inventory carrying costs (ICC)	\$ billion	371.6	373.8	397.7	408.9	426.1	408.0	427.2	412.9	430.0	493.7
Other costs	\$ billion	68.4	69.8	74.4	79.3	82.2	89.4	94.7	93.8	98.1	104.4
Total USBLC	\$ billion	1,062.6	1,125.5	1,221.5	1,274.0	1,318.2	1,400.8	1,428.9	1,410.9	1,468.1	1,635.5
Total USBLC as % of GDP	%	7.4%	7.5%	7.9%	7.9%	7.9%	8.0%	7.8%	7.5%	7.5%	8.0%
Total business inventory as % of GDP	%	13.4%	13.4%	14.5%	14.4%	14.3%	14.4%	13.8%	13.5%	13.5%	13.4%
Transportation as % of GDP	%	4.3%	4.5%	4.8%	4.9%	4.8%	5.2%	5.0%	4.8%	4.8%	5.1%
ICC as % of GDP	%	2.6%	2.5%	2.6%	2.5%	2.5%	2.3%	2.3%	2.2%	2.2%	2.4%
Total business inventory as % of GDP (2011=100)	base 100	92.3	93.0	100.0	99.8	98.7	99.6	95.4	93.4	93.3	92.8
Transportation as % of GDP (2011 = 100)	base 100	89.4	94.3	100.0	100.6	100.1	107.0	103.3	100.3	100.1	105.0
ICC as % of GDP (2011 = 100)	base 100	100.5	97.4	100.0	98.6	99.2	91.0	91.6	86.3	86.2	94.1
Total USBLC as % of GDP (2011 = 100)	base 100	93.6	95.5	100.0	100.1	99.9	101.7	99.8	96.0	95.9	101.5

Source: A.T. Kearney analysis

CSCMP'S ANNUAL STATE OF LOGISTICS REPORT[®]

AUTHORED BY **ATKearney**



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Since 1963, the Council of Supply Chain Management Professionals (CSCMP) has been the leading worldwide professional association dedicated to education, research, and the advancement of the supply chain management profession.

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