

FUTURE TRENDS SHAPING TRANSPORTATION

A WHITE PAPER BY THE GLOBAL SUPPLY CHAIN INSTITUTE

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FUTURE TRENDS SHAPING TRANSPORTATION

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

The 2020 pandemic highlighted the importance of end-to-end supply chain visibility. Where were all the products missing from store shelves? Answering that question required visibility to the physical location, status, and condition of the product in motion. Visibility is more easily achieved within the four walls of a manufacturing facility or distribution center; once a product is out on the ocean, rails, or roadways, establishing continuous connectivity and visibility becomes a far greater challenge, particularly in global settings. Hence, this timely dive into a deeper look at the future of transportation, the chief agent of motion in our global supply chains.

They say hindsight is 2020

In May of 2017, UT's "The Visible Supply Chain" white paper stated that "shippers often don't even know where to start when it comes to pulling in, curating, and integrating vital visibility data."¹ That paper explored the data challenges and offered a suggestion for shippers to "move away from antiquated data formats and toward application programming interfaces (APIs). To be more precise, specialized supply chain APIs built specifically for logistics applications."¹ Supply chain leaders who read and took action on that advice from 2017 would have focused their teams on closing visibility gaps with APIs in 2018

or even 2019. These supply chain teams and leaders would have had an easier time answering visibility questions in 2020.

With "Future Trends Shaping Transportation," we offer another opportunity to spend a little time considering specific challenges facing the transportation industry and reading about best practices from shippers, solution providers, and technology innovators.

Another famous innovator, Admiral Grace Hopper, encouraged leaders to move away from the "we have always done it that way" logic, and to rather try things and "apologize later." Supply chain leaders at companies that we benchmarked for this research embrace this leadership approach. It is an especially important mantra to remember as we all consider the future of transportation. Old approaches are changing across every mode, and new methods of transport will become routine.

This white paper scans the future of the transportation industry and offers insights into the challenges facing it, as well as predictions about the road ahead. Our experiences in 2020 brought the importance of supply chain visibility into clear focus. Products in motion create useful and valuable supply chain data all along these interconnected paths.

Insights presented in this white paper were gleaned from over thirty interviews with industry and academic thought leaders, and the paper also includes spotlights on various transportation industry sectors from an insider's perspective. The future of air cargo, logistics collaboration, ports, and rail is brought to life in insightful, speedy reviews of both challenges and opportunities.

The research found that leading-edge supply chain companies understand that transportation promotes the competitiveness of a supply chain – now and particularly in the future. Importantly, five central themes emerged that will impact how transportation must be managed in the future. Those include the following.

1. Technology will radically alter traditional transportation processes
2. Global supply chains are under scrutiny, while hyper-local designs flourish
3. Last-mile focus shifts to the last yard
4. Tomorrow's workforce: continually training for transformation
5. Agility will be standard operating procedure for transportation activities

INTRODUCTION: A VITAL ECONOMIC ENGINE

Transportation systems make it possible for supply chains to operate at global, regional, and local levels. The value that transportation creates can be seen readily by contrasting the economies of developed countries to those considered to be emerging nations. Transportation plays a vital role in facilitating economic activity, as it enables commerce that expands well beyond a limited production or local market boundary. At a company level, transportation is often viewed as a competitive advantage enabler, by delivering customer expectations and contributing to financial performance that exceeds other companies.

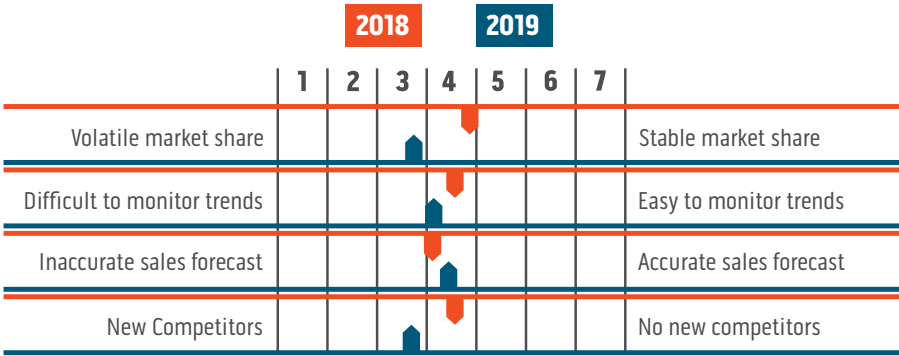
Transportation costs usually represent the largest percentage of logistics costs for most companies, comprising between one-third to two-thirds of total costs. While

transportation users enjoy a wide range of modes and methods, motor carriers (both for-hire and private) are the predominant choice for moving freight. It represents approximately 71 percent of the tonnage moved in the U.S. and 73 percent of the total value of goods shipped.²

Procurement of transportation services consists of evaluating a set of performance characteristics that are purchased at a given price across all modes and methods. Primary factors, in addition to price, such as arrival time, transit time variability, carrier capability, and delivery condition reliability (temperature/damage-free) are consistently part of the decision-making process. What makes the procurement of transportation services process so complex and involved?



Figure 1. An Unpredictable Business Environment



The answer lies in the fact that over the past decade numerous forces have altered the current business landscape for both shippers and transportation providers. Data from the *28th Annual Trends and Issues in Logistics and Transportation*³ indicates that the environment in which companies operate can be characterized as one that is facing more uncertainty and volatility (Figure 1). The combination of the unpredictable nature of markets and the entrance of more competitors makes it difficult to use traditional approaches to today’s operations – much less apply them to supply chain processes and tasks in the future. An abundance of point-of-sale (POS) data has not resulted in more accurate demand forecasting, as products and distribution channels continue to proliferate demand uncertainty, and customers expect shorter and shorter lead times for delivery.

It is not surprising that this business environment has resulted in considerable anxiety for supply chain managers, who are held accountable for keeping costs under control while delivering service that often exceeds expectations. The annual study identified the primary concerns that supply chain managers consistently note as issues for their companies. The top three (Figure 2) involve two interrelated matters – cost to serve and changing customer requirements/demand uncertainty. They have resided at the top of the list for several years. The third anxiety – integration (or lack thereof) of supply chain technology and processes – has recently emerged as companies seek to achieve digitalization of their supply chains.

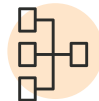
Figure 2. Supply Chain Managers: What Keeps You Awake At Night?



Cost To Serve (Distribution)



Changing Customer Requirements/
Demand Uncertainty



Integration of Supply Chain Technology
and Integrated Supply Chain Processes

Challenges in operating global supply chains are not new. The novel aspect is being able to leverage an end-to-end supply chain, which consists of multiple supply tiers and thousands of suppliers to hundreds of thousands of customers, such that it competes in the marketplace as a single entity against other supply chains. Not only do supply chains compete with one another, they are now increasingly cooperating.

This “coopetition” will continue to complicate future supply chain freight flow strategies and decisions. It will not be sufficient to simply keep up with the competition. Instead, changing customer expectations in both the business-to-business (B2B) and business-to-customer (B2C) sectors should be the basis for driving transformation of essential supply chain processes such as planning,

sourcing, production, distribution, transportation, and last-mile delivery, to support the supply chain’s competitive efforts in the future. In leading companies, digitalization and technology strategies complement the pace and priorities of these process transformation goals.

The future of the transportation industry is anything but business as usual. Challenges that impact a broad swath of the business world are also having a major impact on transportation today and will influence future trends in transportation. In the following section, we will review five of these key challenges and provide insights as to how they will shape the future of transportation.

THE ROAD AHEAD:

CHALLENGES FOR THE TRANSPORTATION INDUSTRY

Movement of products and information in and across supply chain networks requires the ability to execute smooth handoffs between nodes and hubs. How are leading-edge companies working through an ever-more volatile, uncertain, complex, and ambiguous (VUCA)⁴ environment? To learn how, we interviewed subject matter experts in the Global Supply Chain Institute at the University of Tennessee, Knoxville, as well as executives and senior leaders with companies shipping products through these networks. The companies represented diverse perspectives, from shippers to service and solution providers. As usual, the solutions identified blend technology, talent, and approach.

For most supply chains, moving from current to future state implies evolution or revolution as the way forward. However, some will simply stagnate, as they remain insistent in managing their supply chains using traditional approaches. For those moving forward, new (and relatively new) technologies and business concepts will drive transformation that will have elements of both evolution and revolution. To prepare for the future state of supply chain competitiveness,

supply chain managers must anticipate a business environment significantly different than the current state. As discussed earlier, transportation is a key activity in global supply chain operations. Despite the critical nature of this function, it is often viewed and treated as an addendum to strategic planning. Leading-edge supply chain companies, however, have a different mindset. They understand that transportation promotes the competitiveness of a supply chain – now and particularly in the future. What changes are expected in the future of transportation? After conducting extensive research around this question, five central challenges emerged:

1. Technology will radically alter traditional transportation processes
2. Global supply chains are under scrutiny, while hyper-local designs flourish
3. Last-mile focus shifts to the last yard
4. Tomorrow's workforce: continually training for transformation
5. Agility will be standard operating procedure for transportation activities

Each of these challenges will be reviewed on the following pages.

01

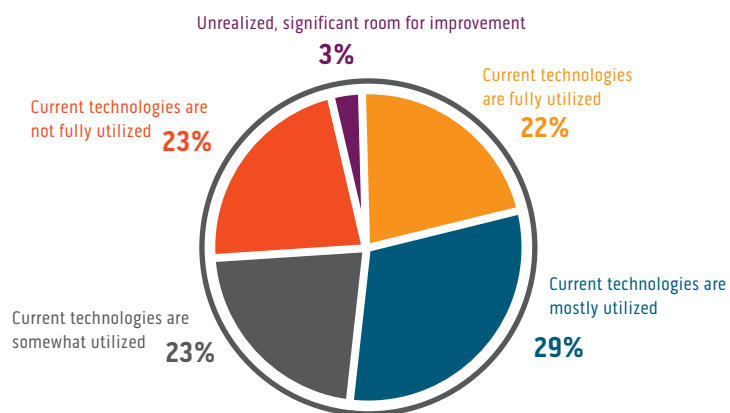
TECHNOLOGY WILL RADICALLY ALTER TRADITIONAL TRANSPORTATION PROCESSES

The known technologies that are in play today in supply chain management – including artificial intelligence, robotics, the Internet of Things (IoT), additive manufacturing, autonomous vehicles, blockchain, telematics, wearables, etc. – have yet to be deployed in a manner that leverages their power as a force to change the traditional ways that we conduct business. Indeed, the processes that are fundamental to planning, sourcing, making, and distributing have yet to fully integrate a host of tools and technologies that can improve performance. It is true that the relatively few leading-edge supply chain companies today use real-time data to see, proactively manage, and control goods as they move and when they rest. However, a sizeable percentage of companies have long struggled with using technology to connect, coordinate, and synchronize supply chain functions and activities.

Specific to transportation, the flow of goods through various nodes in the supply chain generates an abundance of data. However, much of the information these shipments produce is not used to improve the delivery process. Data from the *28th Annual Trends and Issues in Logistics and Transportation* provides some insight into this matter. Of the companies that participated in the annual study, less than a quarter reported that they do not use transportation management software; yet, for those companies that do use software to manage transportation, only 22 percent reported that the technology has been fully utilized (Figure 3).

Figure 3.

A Deficit in Utilizing Available Transportation Management Technology



Additional data from the annual study revealed issues larger than just transportation software. Participants noted that, at a corporate level, the No. 1 barrier to reaching the desired state of supply chain digitalization was a “lack of understanding of the technologies and their impact.” Resistance to change and a “focus on incremental change rather than transformation” were also cited as significant obstacles related to the use of various supply chain technologies.

Technology's Tangled Supply Chain Roots

The root of the problem stems from the fact that many companies have “difficulty aligning supply chain, logistics, and transportation technologies to the overall business goals and objectives.” This will not get easier, especially given the following confluence.

- Technology applications for supply chain are numerous and expanding
- Supply chain is a “target-rich” area for development with traditional underinvestment
- C-suite concern has elevated supply chain's importance and criticality, which has increased funding approvals for visibility, agility, and resilience projects
- The media coverage creates a “boil the ocean” effect, conveying opinions about which technologies could be the real game-changers. This creates lively discussion opportunities with a broader group of non-supply chain leaders, from the board room to the back room (perhaps even your parents have shared ideas with you via zoom!)
- Supply chains currently rely on many legacy systems; a critical tier 3 supplier could be using systems programmed in COBOL
- Alignment on a path forward to make the right technology choices requires ongoing alignment on how to manage all the incoming data, which trigger traditional turf wars; current corporate data governance and strategy approaches are not delivering
- Even within a company, the rate of adoption for a particular technology can differ, as pilot projects to establish proof of concept are often specific to a department or unit
- With each adoption of a connecting technology, the risks of a hack and thus the need for a robust cybersecurity process grows exponentially

Transportation management systems are an example of a mature technology that will need to be aligned or integrated with new information from fleet telematics or autonomous vehicles. Additionally, nascent capabilities will arise from the expansion of the 5G (fifth-generation cellular) network. As the 5G network expands, businesses will be able to connect more devices and build new data insights. Combined with other known technologies, such as artificial intelligence (AI), advanced analytics, and robotics, future transportation has the potential to provide visibility of end-to-end flows of goods involving multiple transportation service providers and modes. Their seamless application interfaces produce real-time data for decision making. The result will be value-added transportation that is faster and more cost-effective in the face of increasing customer expectations for more frequent and smaller deliveries. In the future, under-utilization of supply chain, logistics, and transportation technology will not be an option. It will be a matter of survival.

Electric and Autonomous Trucking

“The future of transportation is connected, autonomous, and electric,” was a rallying cry heard from one leader. That said, autonomous and electric were

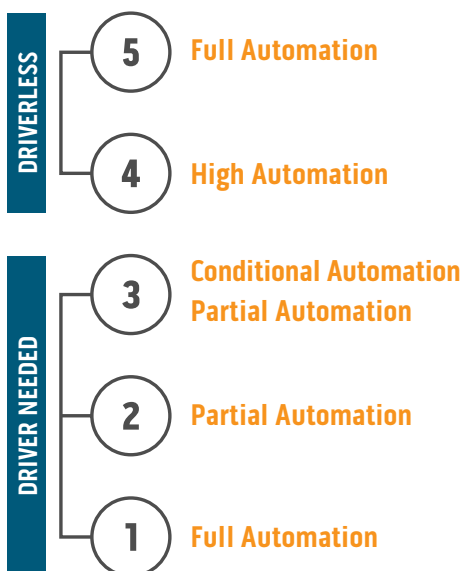
not talked about with equal vigor by supply chain leaders. Both become much more “doable” as routes become more point-to-point and shorter. However, electric and other alternative energy sources were on the upswing while the consensus was that Level 4 or 5 autonomous (see Figure 2, where Level 1 implies no automation and Level 5 is fully automated and driverless⁵) trucking was still at least five to ten years away.

While companies have seen economic benefits moving to more earth-friendly fuels, such as compressed natural gas and renewable biodiesel, most believe electric trucks (EVs – Electric Vehicles) don’t “pencil out” from a total cost perspective. Range anxiety and a lack of charging infrastructure contribute to the skepticism; however, the tide is turning. EV manufacturer Nikola went public in June 2020 and made its founder an instant billionaire several times over. The same week Tesla accelerated deliveries of their EV truck on order from companies such as Ryder, J.B. Hunt, Walmart, FedEx, UPS, Anheuser-Busch, and PepsiCo. UPS ordered 10,000 EVs from UK manufacturer Arrival with an option for another 10,000, and Arrival competitor Rivian received an investment and order for 100,000 EVs from Amazon in September of 2019. Big names like Daimler and Volvo are also investing in the EV market, which is beginning to gain steam and grow.

According to our supply chain experts, key factors beginning to tip the scales in favor of EVs include:

- **Shorter Routes** – Routes up to 150 miles can be reached comfortably without charging, and the range is improving every year. The Tesla EV, for example, promises to go 500 miles fully loaded on a single charge.
- **Increased Demand** – Sustainability is becoming a brand identity issue, and new EU emission standards will go into effect in 2025, holding original equipment manufacturers accountable for adhering to the strict targets.⁶ The U.S. will be slower to transition, but it will be just a matter of time.
- **Charging Infrastructure** – In 2015, a 50K watt EV charging station installed at a rest area on Georgia’s I-85 was considered state of the art. That station was just replaced with a 175K watt charging station and 50K watt wired charging is built into the interstate with 93 percent efficiency of energy transfer for mobile charging. These solutions have yet to scale but show significant progress. In March 2020, the U.S. had almost 25,000 charging stations for plug-in EVs.⁷ That is still only about 21 percent of the 115,000 gas stations in the U.S., but growth is accelerating.⁸
- **Comfort and Safety** – One leader described climbing into an Arrival or Tesla cab as “climbing into the future.” Many of these EV trucks come with regenerative braking, sensors, 360-degree cameras inside and outside the truck, Level 2 autonomy (e.g., the truck can steer, accelerate, and brake in certain circumstances), and the ability to push updates to the truck while parked.
- **Total Cost of Ownership (TCO)** – Several executives commented that as long as fuel costs remain low, it will be hard to make the economics work for EVs. Tesla Class 8 truck prices, for example, start at \$150,000, while the average Class 8 Diesel truck sells for about \$117,000.⁹ However, EV fuel costs are expected to be lower, as well as maintenance costs, since EVs typically have fewer moving parts. Scale economies are also expected to lower the TCO further, but “companies will need to test vehicles in the context of their loads and routes” to understand the true TCO.

Figure 4. Levels of Autonomy



In addition to respondents' enthusiasm for EV applications, they also generally agreed that platooning, where an autonomous truck is led by a driver, is an achievable bridge to full autonomy. Platooning startup Peloton Technologies has completed seven customer trials so far, with a perfect safety record and fuel savings "much larger" than the 10 percent target. Further infrastructure improvements will be needed to embrace autonomy fully. For instance, specially engineered striping that is easier for the EV truck to "see" can be installed. Also, signage that continually projects the nature of its message could be deployed, so that, if heavy rain or snow prohibits the EV truck from reading the sign, it can "hear" the sign.

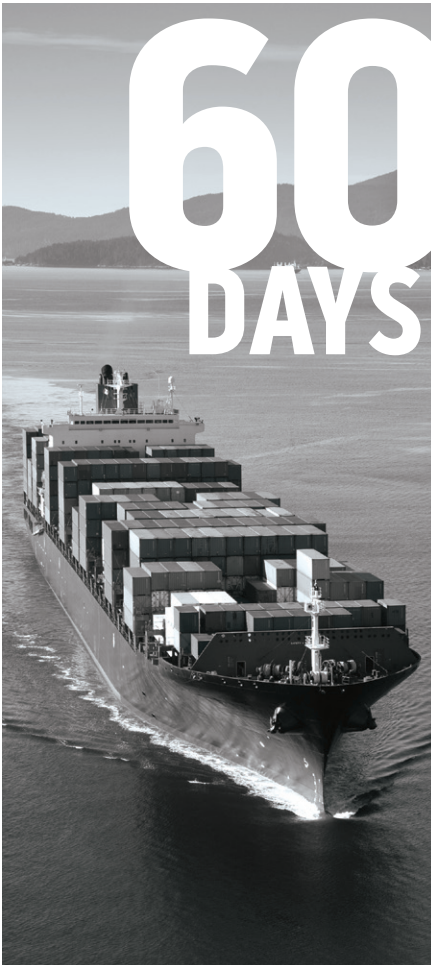
02

GLOBAL SUPPLY CHAINS UNDER SCRUTINY WHILE HYPER-LOCAL DESIGNS FLOURISH

The ultimate goal of all transportation is to deliver product to the final destination, on time, in good condition, and at the right value. In previous years, consumers, customers, and even company executives were often oblivious to the extent of the global movement within their supply chain ecosystems.

Supply chain disruptions compel companies to evaluate network risks. Natural disasters (including the 2009 swine flu, the 2010 Icelandic volcanic eruption, the 2011 Japanese earthquake and tsunami, the three deadly hurricanes of 2017, and the COVID-19 global pandemic that began in 2019) have adversely affected the flow of materials and goods – some for longer times than others. The added complexity and uncertainty of geopolitical relationships have impacted the 10-year growth trend in world trade and GDP, compelling companies to rethink the structure of their supply chains from global to local. This is not to say everything will be produced and distributed locally, although new technologies like 3D printing may mean just that in the future. Traditionally, global supply chains' predominant focuses were often efficiency and scale. Now is the time to consider where technology enables a more local approach to meeting increased consumers and customer expectations. Consider how COVID-19 prompted a team of five teenagers to create a new non-profit PPE supply chain, called Project Paralink, grounded on delivery software developed to identify the most efficient local routes. They located individuals and companies with 3D printing capability to make shields and other PPE for hospitals and delivered it through a coordinated, volunteer effort. This demand and supply match, manufacture, and fulfillment all happens within a few days.

The Internet of Things (IoT), additive manufacturing, advanced analytics, autonomous vehicles, and other technologies make it increasingly possible to relocate critical global nodes in the supply chain to local sites while still achieving cost and service goals. In addition, hyper-local markets have the ability to quickly respond to current and future operating conditions,



COVID-19 exposed new challenges with Asia-U.S. ocean transit times rising to 60 days, rail and ocean services cutting service to manage

particularly during periods of rapid change. It is not as simple as moving from global to local, though. Global supply chains allow specialization of work and flexible capacity that can also be ramped up or turned down as needed. The resulting cost efficiencies are important to the cost of goods sold and ultimately, the company's profitability.

Efficient and effective transportation networks, however, are required to support global supply and manufacturing locations. The weakness of a focused global manufacturing or supply approach is that many companies leverage that specialization to the degree that it results in deep tiering of the supply chain. Multistage global supply chains, along with the transportation networks that connect them from end to end, are complex and often difficult to synchronize even during "normal" business conditions. Add to these the challenges associated with long lead times and greater risk of disruption of flows, and some firms may begin to consider alternatives to the "all global" approach.

Regionalization/Near-Shoring

Regionalization and near-shoring were still top of mind for supply chain executives. One interviewee indicated, "I think you're seeing a lot of changes now with manufacturers experiencing some negatives with the choices they've made with locations they put their supply chains. They've either gotten a lack of agility, or they've gotten too dependent on one area as dynamics change, and geopolitical things change."

Companies are doing more network studies, looking at "How do I do it?" Often, it's not all about minimizing total cost; instead, it comes down to total expected costs. They are studying multiple scenarios that could play out and ensuring that they have options identified in advance.

However, a significant move from China to North America is not being considered by most experts. A representative comment was, "I see a lot of people moving from China to Vietnam and looking at changes like that. I don't see a lot of us necessarily contemplating going from China to Detroit."

Global to Local

Infrastructure shifts supporting localization were a recurring theme throughout the interviews. Manufacturers, distributors, retailers, and carriers that have been in business for at least 10-20 years built their networks around a business context that is changing rapidly. Services and data industries will likely lead the way to a hyper-local approach. According to the McKinsey Global Institute, services and data are growing more than 60 percent faster than trade in goods over the past decade.¹⁰ This is noteworthy because hyper-local markets are in the best position to deliver those services, as they are closest to the customer or consumer.

Production industries are not immune to the trend, however, as low-cost labor is becoming less important as a factor for determining where production will be located and the value in services and knowledge around products increases. Hyper-local markets will play an expanding role in the future as the amount of trade volume that crosses borders continues to decline. The most pronounced decline in trade intensity over the past

decade has occurred in the most complex and largest export categories, like computers and machinery and equipment.

Hyper-Local Focus Driven by Rising Consumer and Customer Expectations

The growing number of consumers who want orders fulfilled and delivered within ever-shrinking time windows provide the impetus behind last-mile delivery. On-demand consumers want what they want when they want it. Retailers have had to adjust to this new reality, but the impact of these consumer expectations has been felt in the business-to-business (B2B) supply chain as well. All of this has created extreme cost and service pressures that have led to the introduction of new supply chain solutions. For companies, this means having inventory located near enough to accommodate same-day or next-day delivery options. Operationally, it requires the ability to leverage parcel, less-than-truckload, and air capacity throughout the global supply chain. Real-time visibility that permits order tracking from end to end is also a threshold capability to compete. Most companies rely on their carriers' application to provide this service.

B2B shippers are not spared from the increasing customer demands. One leader explained how they are building out micro-fulfillment centers to serve smaller format stores (e.g., bars, mom-and-pop stores, gas stations) directly instead of going through distributors. At the same time, irregular route trucking is fading away as more trucking companies want to focus on dedicated fleets and contract logistics.

Rapid delivery requirements are also forcing changes. A key advantage Amazon has built up over traditional retailers is a vast network of over 110 fulfillment centers in the U.S. that enable them to push orders to a distribution center (DC) close to the buyer for same-day or next-day delivery using a lower-cost ground network. Companies with one or two DCs in the U.S. are at a distinct disadvantage.

Consumers are conditioned to expect same-day and next-day delivery. To accommodate next-day delivery, a company must fly it or have the inventory relatively close. If it's same-day, then there is only one choice, according to one participant; "It's going to come down to what your promise is. If my promise is to deliver to you in two hours, I've got to have the inventory relatively close."

Third-party logistics providers (3PLs) are moving toward more multi-client facilities with three to twenty customers in a warehouse. They also see demand for more warehouses closer to consumers, so their customers can flex their inventory as needed to meet consumer service demands.

Retailers are not only updating and expanding their DC footprint but increasingly leveraging their retail stores as fulfillment centers. One retailer turned to fulfill-from-store across its entire network during the COVID-19 pandemic. Like many of the supply chain changes initiated during the pandemic, they will not be turning off fulfillment from these stores post-pandemic.

Grocery stores and retailers doing significant ship-from-store and curbside pickup may change the configuration of their inventory placement from 80-90 percent in-store and 10-20 percent in warehouses to a 60/40 or 50/50 split to accommodate online ordering and streamline the in-store pickup process. Over 90 percent of consumers who have tried online grocery ordering say they will continue to use it post-pandemic.

Many businesses implemented these new customer access models for the first time during the COVID-19 pandemic. This may continue to generate a push to deliver direct to stores versus delivering in bulk to their DCs. The challenge is that many manufacturers are not set up to deliver to stores. New packaging, case configurations, and truck sizes are needed to create additional complexity.

The future will also offer many more options for vehicle selection, and that creates a growing challenge for both B2C and B2B shippers. Larger goods such as furniture and appliances are being purchased online for direct-to-consumer delivery, and manufacturers are seeing an increased demand to go directly to smaller-format channels that may have been serviced by distributors in the past.

For example, one interviewee purchased a refrigerator online, and it was delivered to his residential community in a 53-foot trailer. "It's what they had available," he said. This challenge appeared to be a work-in-progress at most companies. Common questions include not only the size of the vehicle for last-mile, depot, or small-format store deliveries, but also what the cost tradeoff is between diesel and electric for these shorter, more stop-and-go moves.

Clearly, these hyper-local markets are not without challenges and they require operational excellence in last-mile and last-yard logistics capabilities.

03

LAST-MILE FOCUS SHIFTS TO THE LAST YARD

While last-mile fulfillment is a well-known concept amongst supply chain and logistics professionals, the spotlight is shifting to the last leg of the delivery, otherwise known as the "last yard." Before and during the COVID-19 pandemic, e-commerce and retail delivery models quickly combined an array of last-yard options, including autonomous contactless delivery at curbside, touchless trunk delivery, and contactless doorstep delivery. The evolution will continue as technology enables B2B and B2C consumers to specify more customized delivery options, with the customization increasingly involving tracking location and condition over the duration of the shipment.

Over the last several years, distribution and transportation patterns have been changing, reflecting a continuous growth in e-commerce versus traditional distribution channels. This shift has led to smaller order sizes and more frequent shipments – a costlier distribution approach. Consumers are accustomed to buying items whenever and wherever using various technological platforms. They also expect an array of delivery options, such as ship direct or in-store pickup.

E-commerce has placed even more pressure on companies to meet shorter and shorter delivery times in a competitive environment, where many customers have less tolerance for delayed deliveries. The move to e-commerce has put more pressure on forward stocking locations for many companies and reduced reliance on traditional transportation moves that involved DC-to-DC volume loads. It also has altered delivery densities and placed a growing focus on residential deliveries.

While Amazon, Walmart, and other retailers are currently setting records in last-yard delivery, infrastructure development is still in its early stages, with the most progress being made in densely populated urban centers with shorter delivery distances. The ability to deploy flexible delivery methods to execute this strategy is creating a competitive advantage for those companies that can do so. As e-commerce continues to grow, the characteristics of products that are purchased online have also changed over time. Consumers are now ordering items that are heavier, bulkier, and costlier to ship. The shelter and work from home policies experienced during the pandemic accelerated consumer demand for and comfort with ordering new flooring, furniture, and workout equipment.

The value add for many consumers is delivery into the home, which is also the key challenge for many delivery providers, since home deliveries have many more requirements, and, therefore, risk. The last-yard expectations include synching delivery to notification with value-added information like package location, time stamp, and a photo to answer any “what condition?” questions.

The last-yard focus will become increasingly important as consumer and customer delivery demands shift from delivery to a home or office to delivery to them wherever they are. We are increasingly comfortable with our digital content being streamed to us wherever we are. Shared resource approaches will allow better scale for that last yard in the “now” or one-hour delivery.

Autonomous Transportation

Interviewed executives mentioned ambiguity about the timeline for reaching scale on autonomous transportation due to government regulations, a perceived increase in risk, and uncertain liability. Several leaders pointed out that regardless of the improvement in overall highway safety, it will only take one death involving an autonomous truck to create a media storm, damage your brand, and at least temporarily shut down your autonomous trucks.

While the consensus was that autonomous transportation, trucking, in particular, is not ready for prime time, interviewees recognized that smaller, more modular freight movements create an opportunity for both electric and autonomous equipment. One reason today's trucks are so large is because drivers are the highest cost, so the idea is that they haul as much as they can. Another reason involves the traditional combustion engine, which tends to be more efficient as the truck gets larger. As we move toward autonomous and electric, both of those factors are reduced or eliminated. That means that other operational efficiency factors will become increasingly more significant, such as empty miles and wasted miles.

In the future, autonomous vehicle delivery will become commonplace at a hyper-local level, as more cities choose to spur innovation and work with industry to reduce regulatory complexity and ambiguity. Three current examples of cities working to enable delivery innovation are Houston, TX, Ann Arbor, MI, and Pittsburgh, PA. Food and merchandise retailers, drug stores, grocery stores, and others will work out the challenges and make contactless and paperless deliveries possible from their local brick-and-mortar stores. As mentioned previously, last-yard delivery is usually the most expensive leg of the journey because it involves labor-intensive transportation. However, using autonomous vehicles radically changes the cost economics for last-yard delivery, thereby creating a totally new value proposition for companies. Kroger,¹¹ Domino's Pizza,¹² and CVS¹³ have all launched autonomous vehicle curbside delivery tests.

04

TOMORROW'S WORKFORCE: CONTINUALLY TRAINING FOR TRANSFORMATION

Forrester Research estimates that by 2030, 80 percent of jobs will be transformed in some way by AI and automation.

The various technologies discussed in this white paper are just a sample of those being implemented and used to manage supply chain, logistics, and transportation activities. During a recent GSCI Supply Chain Forum partner webinar on Next Gen Supply Chain, Dr. Chad Autry, Department Head and FedEx Professor of Supply Chain Management at the University of Tennessee, presented three rules to follow during this automation revolution:

RULE 1: Automation is indeed happening; tolerate no denial

RULE 2: Re-think the relationship between job roles and job tasks

RULE 3: Begin to create tomorrow's human jobs and design tomorrow's workforce today

Technology's use in distribution and transportation will only increase in the future. It is not the technology per se holding companies back. The stumbling block is a classic business problem – underestimating the change management effort and underinvesting in time and resources in building understanding and adoption. Failures in new supply chain technology and

Benchmark companies design, plan, and measure technology adoption as part of their transformation process.

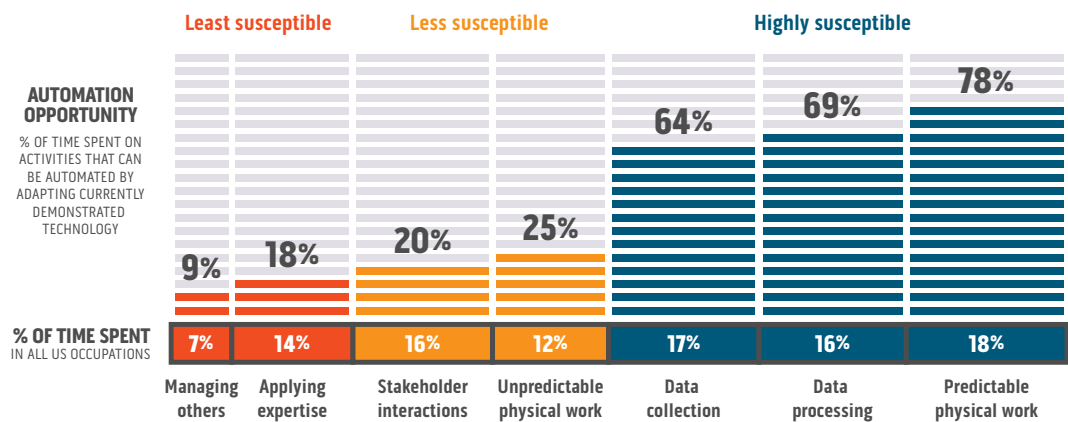
process implementation are commonplace. A major factor in these failures is that companies struggle to help employees understand and engage in the change management effort to integrate automation into their current jobs. Employees’ fear and confusion about this process will only increase. Transparency and training during the change management effort help to encourage engagement and improve adoption.

How many Excel spreadsheets are currently used to manage your supply chain movements? Digitize and then digitalize by getting those processes into a system that makes the spreadsheet information visible to everyone. Research by the National Skills Coalition estimated that 50 percent of construction, transportation, and storage sector workers have limited or no digital skills. Yet, these workers have seen rapid increases in the digital demands of their jobs in recent years.¹⁴ Best-practice companies design, plan, and measure technology adoption as part of their transformation process.

Automation, specifically in the form of self-driving vehicles, will create an evolution in the difference between the delivery roles and tasks. We need automation to assist with a growing driver shortage, which the American Trucking Association (ATA) estimates will result in 160,000 unfilled positions in the next decade. The shortage is most acute in long-haul lanes. While the use of autonomous vehicles for this purpose is promising, actual full-scale implementation beyond pilot programs is still problematic for a number of reasons. Perhaps in the future, a “driver” role becomes more of a route exception manager and security guard.

What is certain is that technology is changing how transportation activities are being executed. Telematics makes it possible to significantly improve driver safety and asset utilization, through real-time access to a driver’s location, job, and equipment status. This is digitalization in action, where technology offers the potential to automate and continually improve transaction processing for a number of back-office logistics and transportation activities. Data-related tasks that repeat every day, such as billing, invoice resolution, or contract management, are just a few that, if automated, could save time and money. Imagine this scenario: in a distribution center, an autonomous warehouse vehicle picks and packs an order and then hands it off to a different type of autonomous vehicle for delivery.

Figure 5. Technical Feasibility of Automation





If companies are going to radically change how they perform distribution and transportation activities, they need more digital skills. Due to the plethora of technological applications, supply chain leaders need to create talent management strategies for current and new team members. Digitalizing an invoicing function to use RPA (robotic process automation) should also include training for understanding variation. Future change management efforts need to be more holistic than the approaches used to implement yesterday's ERP systems. Tomorrow's technology solutions are not cookie cutter. Competitive advantage comes from strategic decisions about the design and, for the most part, integration of tools and solutions within existing teams. The future workforce must understand and be prepared to fully utilize the opportunities presented by the new technology and future digitalization.

As an example, consider how technological innovations have made a driver's job easier, a necessary evolution both to attract a new workforce and accommodate an aging one.

The future of effective talent management in transportation requires a multipronged approach. Focus on closing key skill gaps with current and new employees by considering new approaches, like gamification. How can a company build training and onboarding experiences that help to attract and retain Gen Z or other underrepresented potential target employees? How should leaders attempt to improve technology competency and adoption with their current team and build camaraderie with new employees?

Improving Transportation Work Conditions

Across modes, transportation workers at the front lines are seeing new technology designed to meet customers' need for shipment status and visibility details. Again, consider some examples of changing conditions for truck drivers. According to the ATA, over-the-road drivers in the U.S. are, on average, 46 years old.¹⁵ While the driver shortage was not top of mind for most of the executives during the pandemic, it is acknowledged as a perennial issue. One leader articulated the vision, "We need to make driving a truck the blue-collar job of choice." Supply chain executives are enacting multiple strategies to facilitate this vision.

Quality of Life - The trend toward more regionalization enables the design of shorter routes, which bring drivers home most nights, if not every night. For longer runs, firms are creating relay routes that allow the trucks to move long distances while their drivers return home for the evening.

Driver Accommodations - Several executives talked about all new trucks having automatic transmissions and features such as two-way communications and navigation. Further, solutions like RyderDrive that automate administrative and compliance reporting simplify the drivers' work.

Safety Systems - Many of the new trucks have collision mitigation and automatic emergency braking systems that improve driver safety. According to one executive, "Sometimes, people miss the fact that the vast majority of the safety improvements that autonomous vehicles can bring you, you can already get with the best active safety systems today."

Protecting Drivers from Litigation – Not only do cameras aid in driver safety, they also safeguard drivers if they get in an accident. Cameras can show whether the driver was distracted or sleeping, as well as what happened right up to the point of impact, potentially capturing what the driver was trying to avoid at the time. Even more important is protecting the driver and the company from a “nuclear verdict.” Many executives shared stories of passenger car drivers purposely getting in wrecks with trucks in search of a significant settlement, especially if the trailers are branded with company logos.

05

AGILITY WILL BE STANDARD OPERATING PROCEDURE FOR TRANSPORTATION ACTIVITIES

Supply chain disruptions over the past decade have tested network resiliency. While all supply chains have the ability to absorb shock(s) and quickly respond to interruptions to a certain extent, the magnitude of recent disruptions has eclipsed their capacity to adapt. Standard operating procedures (SOPs) are a set of step-by-step instructions compiled by an organization to help workers carry out complex routine operations. SOPs aim to achieve efficiency, quality output, and uniformity of performance while reducing miscommunication and failure to comply with industry regulations.¹⁶

During the 2020 COVID-19 global pandemic, the transportation links that moved food around the world were tested in unprecedented ways. Every transportation mode and method struggled to adjust to rapidly changing conditions. Cargo ships struggled to balance blank (canceled) sailings from China and to change crews and move goods between ports. Passenger airlines grounded thousands of planes, slashing air freight capacity that had previously been moved as belly cargo. This contrasted with a massive increase in demand for just-in-time and home deliveries to many companies and consumers at the end of the supply chain. The same supply chains that created value through efficiency were tested as lean operations and had resulted in little excess stock in several critical industry sectors. If there is a positive side to supply chain disruptions, it is that they often necessitate permanent change to current operations, given their economic ramifications.

In the future, supply chain nodes and the transportation networks that connect them will need the ability to foresee or predict disruptive events and offer options for mitigation. Contingency plans and measures will form the basis for operations that are responsive and agile during periods of disequilibrium. However, it is more than just having an alternative “Plan B.” For global or domestic transportation, adding a node, such as a new supplier or a new distribution channel, has the potential to meaningfully impact current freight routes – and not in a positive way. Often, widescale disruptions push other companies to try to do the same thing, which leads to a surge in demand and subsequent increases in price. Depending on the type and scale of a disruption, service performance can suffer as customers switch to alternative distribution channels, overwhelming the resources allocated to that market pathway.

E-Commerce

Reconfiguration of suppliers, the repositioning of inventory, and significant shifts between distribution channels are just a few of the situations that transportation must manage to keep operations as routine as possible. Response and recovery time across transportation modes and methods in the event of a global disruption will become a competitive differentiator in the future. This is why the hallmark of many responsive delivery models is not efficiency; it is speed and agility. During the interview discussions, agility repeatedly came out as the focus for solving e-commerce and omni-channel challenges as well as broader disruption issues.

Figure 6.

THE VUCA FRAMEWORK

While the pandemic shut down theaters across the globe, it brought the term “supply chain” onto everyone’s screen and put supply chain leaders and team members on center stage. The general public, government policymakers, C-suite executives, and other corporate functional leaders all watched as supply chain networks faced tremendous volatility, uncertainty, complexity, and ambiguity with varying degrees of success. As one executive put it, “Just like 9/11 elevated the role of the CFO, The COVID-19 pandemic has elevated the role of the chief supply chain officer.” As economic demand shocks closely followed initial supply shocks, it became increasingly difficult to bring clarity to the status of global supply chain networks in this VUCA environment, even in companies with industry-leading visibility. In fact, among the first reactions to the COVID-19 crisis among supply chain managers was conducting daily war room updates with key transportation partners to identify breakdowns and determine contingency plans for moving product throughout the supply chain, particularly as various nations shut their borders to try to contain the spread of the disease. The “just get it done” mentality often saw transportation partners carrying product for rival firms when doing so made it possible to move product; one manager noted that during that period, contract terms essentially “went out the window.”

The following characteristics define a VUCA supply chain environment:

Volatility – speed of change

- Consumer and customer interests, product tastes, and service expectations
- Social media impacts to the speed of information sharing and impact on above
- Changing nature of social sharing and resulting transparency to business operations and decisions (in your company and at your customers and/or suppliers)
- Rapid technological innovation quickly changes perceived opportunities and risks

Uncertainty – ability to predict the future

- How will all critical factors in your supply chain network (from supplier’s suppliers to end consumers) be influenced by social, political, and environmental changes over the short- and long-term?
- How reliable are all the critical nodes and hubs in your supply chain network?
- Paradox of choice (greater selection means more anxiety and difficulty about choosing) and analysis paralysis are exacerbated by growing technology options making it difficult to maintain executive alignment to a course of action

Complexity – many critical and interconnected factors

- Mergers, acquisitions, divestitures, joint partnerships, etc.
- Global trade and changes in global network designs
- Regulatory or policy changes that impact key supply inputs or demand outputs
- Omni-channel and e-commerce intensifying retail transformation and amplifying consumer- and customer-centric focus

Ambiguity – difficult to interpret due to incomplete or contradictory information

- Increasing disconnects in international, federal, state, and local governance restrictions
- Increasing disconnects in general belief in and value of expert opinion and/or experience
- Business relationships are an increasingly amorphous blend of competition, cooperation, collaboration, and sharing – and continually changing
- Business relationships are an increasingly amorphous blend of competition, cooperation, collaboration, and sharing – and continually changing
- Lack of alignment and discipline among corporate C-suite leaders fogs focus on crafting clear strategies for supply chain design and execution
- How are these bigger societal, political, and environmental conflicts impacting your company or team culture? Do they create internal or external conflict across teams?

Call it the rise of the on-demand consumer, the “Amazonification” of retail, or whatever catchy phrase you would like; the demand for instant gratification is not likely to subside. Solving the Rubik’s Cube of doing same-day and next-day delivery or pickup profitably is a considerable challenge. The small package carriers designed their ground networks to allow for consolidation, a traditional efficiency lever honed over many years. However, same-day and next-day deliveries leave little time for consolidation, challenging not only the carriers but the shippers with limited distribution centers and the transportation providers delivering to more locations, more often.

Amazon uses traditional carriers, and it has two delivery models, which often work out of the same Amazon Delivery Station. The first is Amazon Logistics, which is an independent contractor network. The second is Amazon Flex, which is the delivery program working directly with gig economy workers. Walmart has been equally innovative, using not only contractors and gig economy workers but on occasion, their store employees as well.

The trick, of course, is how to make any money doing these quick deliveries. One solution is to make these B2C shipments look like B2B shipments through a consolidated delivery to a FedEx Office, UPS Store, CVS, Walgreens, etc. Another solution is to lean in hard on AI and machine learning for route planning and optimization. The promise of making open delivery networks as (or more) efficient than traditional closed networks is the Holy Grail for countless companies. In many companies, ballooning stock-keeping units (SKU) counts hamper network efficiency.

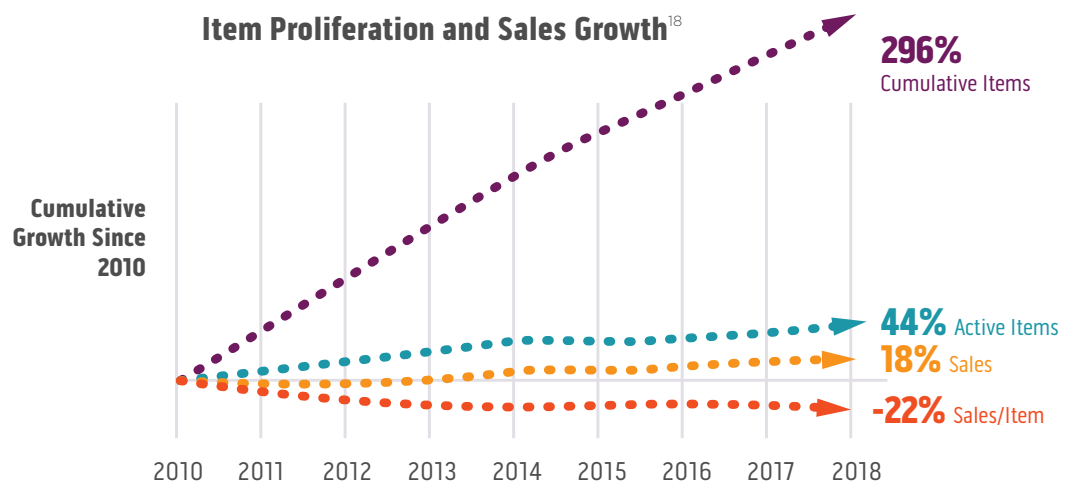
SKU Complexity¹⁷

One constraint that continues to dog attempts at agility is the increasing number of SKUs with which supply chains must contend. A simple search for “light bulbs” on Amazon.com will return over 10,000 results. As consumers demand what they want, the number of SKUs has exploded. A liquor distributor that sold about 10,000 cases per month of a mass-market bourbon is now accommodating customer demands for independent craft bourbons that may sell about 10 cases per month. SKU proliferation was a common issue expressed by leaders, and same-day/next-day delivery has gone from luxury to table stakes. These changes have created trucking runs that are shorter, more frequent, and lighter than the typical manufacturer-to-distributor bulk moves. Another leader in the CPG industry noted that while more SKUs are necessary for growth, it’s adding more miles, more routes, more customization, and more complexity. As SKUs rise, regional DCs are receiving truckloads with more items on them, requiring the DCs to break down the load further before sending goods to the stores. Of course, the stores have limited space in the back room, so they’re pushing the products back up to the DCs and requiring more frequent deliveries. All of this creates new demands for labor and space in the warehouse. One leader lamented that they used to have about 50 pick faces, and now the number has ballooned to 300.

During the pandemic, Amazon prioritized essential items for faster delivery. This approach could have planted an educational seed with consumers related to categorization. Identifying essential (don't run out) items is a natural first step for consumers to consider subscription, which brings more predictability to delivery.

Leading companies are not letting their pandemic supply learnings go to waste. If a company's item proliferation and sales growth follow the patterns identified in Figure 7 below, E2Open's "2019 Forecasting and Inventory Benchmark Study," then the pandemic offered an opportunity. Some companies have announced the elimination of SKUs to increase agility and create more value-added focus. Other supply chain leaders are hoping this can result in more candid conversations about the value of the new item churn with no systemic process to cull underperforming items.

Figure 7.



Retailers are dealing with SKU proliferation by offering a greater selection of goods online and having certain products available online-only so they can be drop-shipped directly to the buyer. Another strategy is to simplify the sizes, colors, or options for a particular item. Paradox of choice is real for consumers, and the integration of marketing and supply chain analytics will help bring more discipline to the benefit (or harm) when an organization is determining the value of adding variety. Analytics across an organization will collectively help move it forward, taking a more "facts are friendly" approach to making tough decisions.

A path forward is already evident at some leading-edge companies who have:

- Built bonus structures to reward more for profitability versus sales growth
- Embraced and fostered analysis that includes supply chain resilience and agility goals
- Permeated their new-item development process with an end-to-end and lifecycle perspective

SECTION SUMMARY

Transportation navigates increasingly volatile, uncertain, complex, and ambiguous territory to deliver product and delight customers. Technology is already radically altering transportation processes. Supply chain networks, from global to hyper-local, must all be designed to deliver through to the last yard. This is just basic best practice in a customer-focused end-to-end supply chain design. Current and future workforces need to be continually training for the race so that when disruptions happen, they are ready to persevere and succeed. That future workforce needs to be designed based on the organization's future path. What roles does the company now need to help create the future? As Figure 8 shows, business roles continually evolve based on new technology, customer expectations, and process innovations. Disruption is the mother of invention. What new roles have you created in your organization since the pandemic began?

Figure 8.



TRANSPORTATION SECTOR SPOTLIGHTS

Let's take a deeper dive into how these five themes are playing out in various transportation sectors. What does the future look like from a different lens? The themes concerning technology and talent seem to have universal application. The shifts in global supply chains with growing hyper-local focus and the increasing pull of e-commerce are impacting all sectors. While each sector is accustomed to a VUCA environment, managing disruption as a standard operating practice is much harder in some sectors. These spotlights from our industry partners bring more clarity to future transportation trends and offer insightful food for thought on our road ahead.



SECTOR SPOTLIGHT

AIR CARGO'S NEXT AND NEW NORMAL



Michael Steen
Chief Commercial Officer

Atlas Air Worldwide



The air cargo industry in the twenty-first century serves a world that is connected and transcends distances – where producers and manufacturers rely on just-in-time delivery from operations located around the globe. This globalization of the marketplace has served consumers and businesses well, and efficiencies have been created. Consumers have more choices at affordable prices. All of this has benefited the air cargo industry.

This integrated nature of the global supply chain has been critical to responding to the COVID-19

pandemic. All industry segments and regions have been impacted by the pandemic, affecting every aspect of how business is done. With the pandemic has come skyrocketing demand for life-saving medical supplies and essential consumer goods to move quickly, internationally and within national borders. This was particularly challenging given that air cargo capacity was slashed due to dramatically reduced passenger flights. Yet, the air cargo industry responded with agility and innovation to bend with the tide of change and even thrive through the disruption.

The industry has worked together during the pandemic to be innovative, creative, and flexible to ensure that airfreight could continue, and it continues to do so. Still, the pandemic presented the industry with an opportunity to examine its processes and procedures and identify areas of improvement. In particular, the crisis has raised awareness of the need for increased digitization of systems, the creation of standards, and the establishment of rules and regulations to facilitate improved utilization of technology.

Additionally, the pandemic has had a profound impact on

airfreight capacity. In a “normal environment,” 50 percent of all global airfreight rides on dedicated freighters, and 50 percent flies in bellies on passenger aircraft. Today, up to 80 percent of the passenger belly capacity is parked because of the pandemic, and it is uncertain when this capacity will come back to the market. This has consequently increased the reliance on freighters, for which shippers will have to review their capacity strategies and build integrated partnerships with forwarders and airlines.

In many parts of the world, there is great innovation underway to usher the global air cargo industry into the twenty-first century digital age. In these “air cargo communities,” all members of the supply chain have fully digitized the process, aligned on technology standards to allow interoperability, and worked with government agencies to create the necessary regulatory environment.

Once digitization processes and standards are in place worldwide, the industry will be better positioned to adopt the technological breakthroughs that are happening at an increasing pace. Customers will receive better, quicker service and

companies will realize significant opportunities to increase revenue while reducing costs.

Looking ahead to the post-pandemic world, demand will continue for the speed and reliability airfreight offers, particularly with high-value and time-critical cargo. Widespread adoption of new technologies will be essential to meeting that consumer demand. With these innovations in place, the global air cargo industry will be poised and ready to address the next wave of challenges on the horizon.

One trend that will affect the air cargo industry is the growth in consumption resulting from an increase in the urban population. It is expected that up to 68 percent of all people could be living in urban areas by 2050. The gradual shift of the people from rural to urban areas, combined with the overall growth of the world's population, could add another 2.5 billion people to urban areas by 2050, with close to 90 percent of this expansion taking place in Asia and Africa. With these shifts, global consumption is forecasted to surpass \$30 trillion – an increase from \$22 trillion today.

Another key trend will be the globalization of trade, finance, people, and data. Of particular impact on the air cargo supply chain, manufacturing is increasingly moving away from traditional passenger hubs, making even more critical an integrated supply chain that can move goods within and through borders quickly.

Perhaps one of the most significant trends to watch is the growth of e-commerce. One may be surprised to know that e-commerce currently makes up only 16 percent of global retail sales, and much of that is comprised of streaming media. A key enabler for the rapid increase in e-commerce is increased access to the internet. For example, an estimated 50 percent of China's population, or about 700 million people, have access to the internet. That leaves a remarkable potential upside of future consumers with disposable income who will be able to make e-commerce

based transactions. As e-commerce grows, consumer expectations for fast deliveries will also grow. The growing expectation of two-hour delivery in urban areas and 48-72 hours worldwide will require an efficient supply chain to move these products. Airfreight is crucial to make this happen!

With the partnership of all the global air cargo supply chain players – manufacturers, transportation providers, intermediaries and service providers, regulatory agencies, etc. – there will be a more coordinated drive toward a digitized world of the twenty-first century to satisfy consumer demand. Making that transition will not only improve the industry's ability to provide service in times of steady state but also will strengthen the agility of the industry to meet the challenges of the future. Difficult times can result in transformative leaps in innovation; the global air cargo industry is poised to make such a leap. ■





SECTOR SPOTLIGHT

E-COMMERCE COLLABORATION



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Transportation & Logistics
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Wally Devereaux
Managing Director

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Air cargo, like every mode of freight transportation, has experienced significant disruption in the COVID-19 world. Based on industries and commodities, there have been clear winners and losers. One area that has seen tremendous growth is e-commerce.

The pandemic has caused steep increases in e-commerce volumes. According to research by eMarketer (TechCrunch 6/8/20), U.S. e-commerce sales will jump 18 percent this year due to the impact of the pandemic, reaching \$709.87 billion. This represents 14.5 percent of total U.S. retail sales.

Not surprisingly, COVID-19 has prompted even faster adoption of e-commerce as consumers shift to touchless orders and delivery options, according to McKinsey. While some of these transactions will shift back to in-person as the economy reopens, the “next normal” includes a reset baseline of e-commerce-related volumes that will undoubtedly continue to grow in the foreseeable future.

Shippers face the question “As e-commerce volumes continue to grow, how do I diversify my logistics options to keep up with demand?”

In the United States, e-commerce logistics is often associated with FedEx, UPS, the U.S. Postal Service, and Amazon. But there is a highly effective, if lesser-known, alternative. For decades, passenger airlines and air freight forwarders have partnered to move hundreds of tons of time-sensitive products to points throughout the country and the world.

A few facts about air cargo:

- Air cargo provides about 35 percent of global trade by value, according to the IATA (International Air Transport Association)
- Airfreight includes pharma, consumer electronics, auto parts for JIT delivery, and perishables such as fruits, flowers, vegetables, and many other commodities
- There are approximately 3,600 TSA registered Indirect Air Carriers (IAC), also known as airfreight forwarders

Specifically, “zone skipping” mail, while not new, is an excellent and economical option for B2B and B2C shippers. Hassett Express has worked with Southwest Airlines and other commercial airlines

to provide same-day airfreight services for over 30 years. In the 1980s and 90s, Hassett worked with magazine publishers to manage the transport of 95 percent of all time-sensitive periodicals. The delivery chain included print plants, ground transportation providers, commercial airlines, and the USPS.

How does this model work today? Highly specialized freight forwarders typically play the role of quarterback. They work directly with all points of the logistics chain: shippers, manufacturers, retailers, airlines, long-haul, local trucking companies, and even the U.S. Postal Service. The freight forwarder works in a 3PL capacity, coordinating the unique strengths of each party to move goods from point A to B (or C or D) in an efficient, expedited, and cost-effective manner. In addition to designing customer-specific solutions, the freight forwarder / 3PL must ensure that data flow and connectivity between the transportation touchpoints work in such a way to detect and prevent potential delays and provide shippers with tracking visibility.

Commercial airlines offer the unique ability to move today what others would move overnight. This is an important capability as businesses and consumers expect goods to arrive quickly in the world of e-commerce. Airlines have moved cargo in the bellies of their aircraft dating back to the early days of aviation. Airmail was and is still a very common commodity moving in the belly of flights all over the world. Other commodities have come and gone, like unprocessed 35mm film and canceled checks for banks. But

these commodities have been replaced with goods that reflect today's modern world, including time-critical commodities like medical diagnostic specimens, pharmaceuticals, certain perishable and high-value goods, and the seemingly unstoppable growth of e-commerce related goods.

This innovative and highly orchestrated process between partners provides tremendous levels of capacity. For example, Southwest Airlines, which flies exclusively narrow-body Boeing 737 aircraft, offers 10 million pounds of available weight for air cargo per day when operating a full schedule. Even with the schedule reductions caused by COVID-19, Southwest still offers close to five million pounds of available space per day. That's significant on its own, but when combined with other passenger

carriers, the daily amount of available air capacity provides an immediate and substantial logistics opportunity for e-commerce shippers. Couple this with the unsurpassed capabilities of the U.S. Postal Service for final-mile delivery, and B2C shippers have a viable and highly reliable shipping alternative.

Technology solutions have improved over the past few years, but there needs to be even more investment in solutions and tools that connect all parties in the delivery chain. Forwarders must have a platform that allows them to handle varying shipment volumes, monitor movement, respond to changing conditions during transport, and connect to a variety of transportation



providers. Forwarders and airlines need connectivity to track the air portion of the move. Carriers like Southwest and others have recently made great progress to offer plane side scanning of commodities at a piece level as they are loaded and unloaded from the aircraft. These solutions, when integrated with the forwarder, provide a level of visibility that didn't exist just a few years ago and greatly reduce the need for manual information gathering.

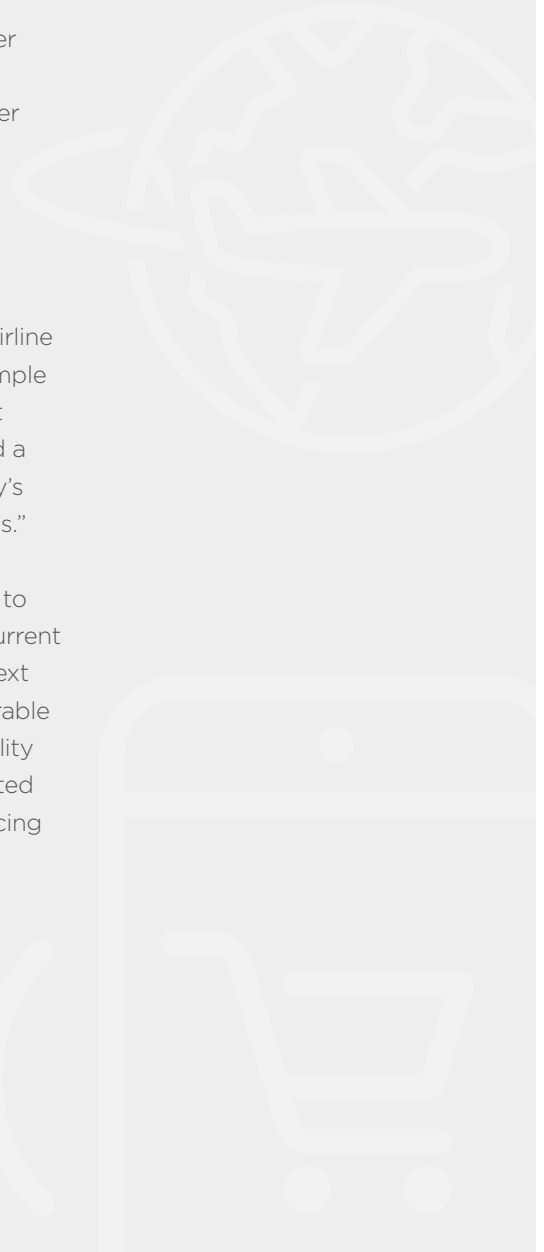
The freight forwarder/commercial airline model provides service quality comparable to an integrated model. In one large-scale example, on-time performance exceeds 98 percent on regular basis. In addition to a high-performing delivery chain, the economics are favorable as individual small parcels can be consolidated in larger boxes, averaging down the cost per box.

Freight forwarding features an innovative model built on collaborative partnerships through a variety of transportation partners, which results in a seamless delivery experience to the end customer. The forwarder and airline partnership enables B2B and B2C shippers to meet the growing expectations of their customers.

While this alternative might not be for everyone, in today's world of rapidly growing e-commerce demand, disrupted supply chains, and peak season capacity crunches, the "next normal" should include a portfolio of logistics solutions that ensure customer demand and service quality expectations can be met under diverse circumstances.

Brandon Fried, the executive director of the Airforwarders Association, says, "The coordinated effort between airline and forwarder is a prime example of how relationships and trust among partners have enabled a highly viable solution to today's expedited B2B and B2C needs."

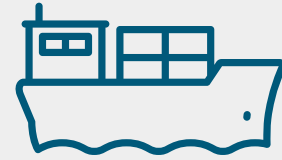
All supply chain players need to be focused on not only the current "new normal," but also the "next normal," and the next. Measurable solutions that combine reliability and flexibility, along with trusted partners, will be the key to facing the future. ■





SECTOR SPOTLIGHT

OCEAN/PORT CHALLENGES 2025



James I. Newsome, III
President and CEO

South Carolina Ports Authority

Container shipping is fundamental to the globalization of the world economy and the rise of a significant middle class in emerging market economies. Ten major global container shipping companies carry about 280 million loaded TEU (twenty-foot equivalent units) annually. Over the last 25 years, as manufacturing was offshored to lower-cost countries, Asia became the focus of this activity, with the two largest trades in the world being those between Asia and Europe and Asia and the United States. Today, U.S. ports only account for seven percent of global port throughput when loaded and empty containers are included. Seven of the world's top 10 container ports are in China.

The global container shipping industry has struggled to achieve consistent profitability over the course of this century. Record losses in 2009 were followed by record profits in 2010, while nothing fundamentally changed in the industry except demand and capacity control. Container shipping is a capital-intensive service industry, which has historically conveyed significant, incremental revenue and cost behavior to the industry and attendant cyclicity. Recently, the container lines have achieved more stability through the formation of three major alliances and outright consolidation, leading to a more logical and sustainable industry structure.

One major strategy for lowering unit costs has been and continues to be the employment of larger container ships. Capacity growth in the industry has largely been achieved through increasing the size of ships, rather than the number of ships. These larger ships work well in the major alliances outlined above, providing both good scale economies while preserving competition between lines sharing vessels. These large ships have, however, created a significant and challenging investment requirement for ports and terminal operators. Every

dimension of a port changes in handling mega-container vessels, from wharf strength, berth length, size of cranes, to harbor depth. Ports must not only account for diminishing autonomous growth, but also the need to handle ever-larger vessels. Ports operate in both the public and private realm, and prioritization is a critical factor in such infrastructure investments; though it is not easily accomplished.

Significant challenges exist and must be addressed to provide a consistent and sustainable return for the industry, allowing the provision of high-quality services at reasonable prices.

1. Lower Growth Rates and Demand Uncertainty

- It has long been accepted that demand growth would return to more normal levels, approximating GDP growth. The trade growth multiplier of GDP was consistently three to four times in the high-intensity era of offshoring between 2000 and 2010. Global trade routinely grew at above 10 percent per annum then, but that's no longer true. Aligning timely supply of vessels with uncertain and lower growth demand is a consistent challenge for this industry.

- Questions about continued globalization versus regionalization of supply chains abound. One main question is the continued preeminence of China in global sourcing decisions. China ships about 60 percent of the cargo volume in the transpacific trade between Asia and the United States. Global ship fleets and ports have been sized and developed to handle trade with China. Is it likely for large scale shifts in manufacturing from China to Southeast Asian countries to occur? Also, what is the potential for sourcing to move to more regional locations such as Mexico when supplying the U.S. market? At this writing, about 75 percent of goods sourced in China still incur a tariff when imported to the U.S.
- In major consuming countries with large geographies, such as those in North America, will the consistent shift in cargo flows between port ranges continue? Over the last 20 years, cargo flows have consistently shifted from U.S. West Coast ports to U.S. East Coast and Gulf Coast ports. There are many reasons for this. Will this persist, or will the growth in e-commerce and omni-channel supply chains once again place more of a premium on speed in global supply chains?

2. Increasing Ship Size as a Strategy for Lowering Unit Costs

- As stated, the dominant theme in the global container shipping industry has been the use of increasing ship size as a way to lower unit costs. At the turn of the century, many lines still held onto the idea that the largest desirable ship size was that of Panamax nature, or 5,000 TEU. Today, ships of 24,000 TEU are being employed in the Asia/Europe trade, and designs of even larger ships are purported to exist.
- The introduction of the global requirement to use low sulfur fuel (IMO 2020) plus the emergence of exhaust gas cleaning systems (scrubbers) seemed to also dictate more demand for larger vessels.
- The unfettered trend to larger vessels seems now to be abating, as some industry leaders discern that there are diseconomies of scale with such vessels, plus port infrastructures' abilities to accommodate them are being taxed.
- Potentially, this is not dissimilar to the airline industry, where the largest aircraft are losing favor to more intermediate sizes. The thought in the container shipping industry is that the 14,000 TEU vessel may be the optimal size.

3. The Challenge of Modernizing and Improving Productivity in the Container Port Sector

- Large investments are required to remain relevant in the container port sector. In the United States, the top 10 container ports account for about 82 percent of U.S. port throughput, and this percentage will only get larger. A new container terminal today can easily cost \$2 billion.
- How are largely public sector investments in such port infrastructure to be rationalized and justified in an increasingly low-growth and uncertain demand environment, given that port infrastructure is a major economic development tool for regions? U.S. port infrastructure is particularly expensive and takes long lead times to achieve.
- How can port productivity be improved to allow better utilization of port facilities? Certainly, automation has by no means proven to be a panacea. U.S. port productivity and costs significantly lag that in the rest of the world and is a major source of consternation for global container shipping lines.

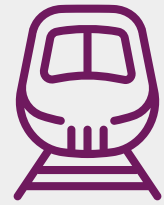
The new container shipping industry structure, achieved through consolidation and alliances, seems to offer new hope for financial stability in the industry and a more logical platform to address some of the major industry challenges outlined above. What is needed is a more strategic vision on the part of all industry players that recognizes that strong players are needed in each sector to ensure success. ■





SECTOR SPOTLIGHT

RAIL RENAISSANCE OR ONE-TRACK MIND?



Ben Sharpe
Superintendent of
Operations

BNSF Railway

Opportunities abound where steel wheels meet steel rails — as long as we have the mindset to take advantage

slow down for a red signal. Future PTC enhancements could result in increased capacity and efficiency gains, enabling us to operate more seamlessly. Currently, most trains operate based on a signal system spaced at three- to four-mile intervals, meaning trains often are 12 miles apart. A loaded 15,000-ton train can take a mile to stop at 50 mph, therefore technology enhancements could allow for trains to operate safely closer together.

Railroads now have detectors installed on the tracks that can look at the sides and undercarriages of locomotives and cars as they roll past at track speed. Both of these technology enhancements have helped reduce train accidents and derailments by 34 percent in the past two decades. Employees are safer, too, with job injuries dropping 53 percent since 2000, according to the Federal Railroad Administration, and injury rates are now among the best in large industries.

With all of these enhancements, efficiency has naturally increased, with railroads seeing operating

ratios plunge an average of 13 percentage points since the turn of the twenty-first century.

So volume must be fantastic, right? Looking at the years between 2000 and 2019, the American Association of Railroads (AAR) reports volume on railroads has increased by only two percent, while GDP has increased by over 30 percent. How can that be? Let's look at it by commodity. Volumes quoted are from the AAR unless otherwise noted.

Intermodal: This is the good news story. Volume is up 30 percent. That volume is largely for moves of more than 1,500 miles, which is great; but what about the 500-1,500 mile segment? Industry estimates are that, overall, rail holds less than a 20 percent market share in this segment, with trucks taking the remainder. This accounts for approximately \$400 billion in revenue ton-miles of potential, according to estimates by Oliver-Wyman, a leading management consultancy.

Grain: Overall, volume is flat. Railroads move wheat, soybeans, corn, fertilizer, and, more recently,

The rail industry is now the safest, most efficient, and profitable it has ever been. Thanks to advances in technology a single locomotive engineer can control a three-mile-long train by using multiple locomotive groupings spread throughout the train.

The modern locomotive is so fuel-efficient that railroads can move one ton of freight more than 450 miles on a single gallon of diesel fuel.

Positive Train Control (PTC), a system of braking that came into existence in 2014, can help prevent train collisions by initiating braking independently if a train doesn't

ethanol; however, overall demand here has remained stable. What railroads have done, though, is vastly expand the unit-train grain network by incentivizing entire dedicated unit-trains from a single large elevator, significantly increasing the efficiency of the fleet.

Coal and Other Energy-Related

Business: Coal has been on an overall steady decline, with volume in 2019 at a meager 53 percent of the peak volume in 2006. This is primarily driven by lower natural gas prices. The railroads picked up some additional volume hauling crude oil during the peak of the Bakken oil boom, plus more volume transporting sand and pipe to support fracking. Windmill blades began shipping on rail, too, because of the increased demand for wind energy. But that's all a drop in the bucket compared to the fact that, at the height of the coal boom this century, railroads moved over 8.5 million carloads of coal in 2008.

Carload/Merchandise: The single carload business has been on a slight, but steady decline since 2000, dropping about six percent overall. That can be partially attributed to factors related to working on a customer-by-customer basis. Because of the complexity and the lack of density on a specific customer-by-customer basis, railroads handle the single carloads like an airline's hub and spoke system, except the average single carload is handled four times from origin to destination.

So, what's the path forward for the industry? Grow and adapt, or take the easy way out? I can't think of a railroader out there that will tell you that more business is a bad thing. Some key ways to get there are first, to demonstrate consistency in service to customers (which railroads have striven hard to do and have improved overall in recent years), and then be able to sell that consistency within the entire supply chain. One creative way that BNSF Railway is working to attract more carload and unit train business is through a logistics center concept.

Logistics centers offer direct-rail service in multi-customer, multi-commodity business parks. BNSF differs from private business parks by investing directly in the development of the facility to create sites in underserved, strategic, and primarily end-user markets. This also has the advantage of saving nine months or more of development time with a fully permitted, shovel-ready site with rail infrastructure already in place. Also, we talked about the significant technological advancements the industry has made, although many of these (but not all) are internal. Rail industry consultants Sonia Bot and John Orr suggest that by leveraging technology to allow customers visibility of their shipments across all railroads, encompassing entire supply chains on one platform, we can more fully utilize the vast 140,000 miles of rail network to reach a whole new level of being a premium transportation partner. Exciting times in the transportation industry are undoubtedly to come, and the next wave of a rail industry renaissance may just be right around the corner. ■



CONCLUSION

Like earthquakes in California, it is not a matter of “if,” but “when.” Supply chain networks will continue to operate in the middle of volatile, uncertain, complex, and ambiguous environments. Preparedness is the best solution. It is easy to get caught up in the rush of the urgent and forget the power in deep thought. Reading white papers like this is one way to identify areas of opportunity. Whether your business is battering down the hatches or letting out the sails, the best way to plan for unexpected scenarios is in expanding your horizons.

Free shipping is not free. As customer expectations rise, their willingness to pay does not necessarily grow in step with cost to serve. The desire to get more for less is not going away, creating tremendous cost and service pressures up and down the supply chain. If there was a silver lining in all the executive interviews, it was the level of innovation being driven in these companies to meet the challenges of a rapidly changing

marketplace. New distribution networks, last-mile delivery solutions, collaborative efforts, and the implementation of technology applications are raising the bar on what it means to be best in class.

This is an exciting time to be in transportation. Never before has the role of the transportation professional been so critical in so many industries. The e-commerce ripple effect, driver shortages, and regionalization will continue to challenge companies for the foreseeable future.

Several executives also expect more consolidation in the transportation industry over the next three years. “The big will get bigger.” The march toward full digitalization will continue, and disruptions are predicted to move from exception to expected, increasing the need for advanced communication support models. Last, but not least, transportation leaders are determined to figure out how to attract more people to the profession. Bottom line, VUCA continues.

The five themes in this paper are a navigation aide. Competitive advantage in a VUCA environment comes from continually scanning and considering future scenarios. In supply chain, agile leadership focused on end-to-end integration is a clear differentiator. Our benchmark companies have built these themes into their current strategic planning and, in some cases, daily execution.

What drives their progress and discipline? It’s an attitude, a driving optimism about what can be, and the conviction to convert ideas into action that have always been defining characteristics for leaders. Amidst all the change and uncertainty, those critical characteristics have not changed.

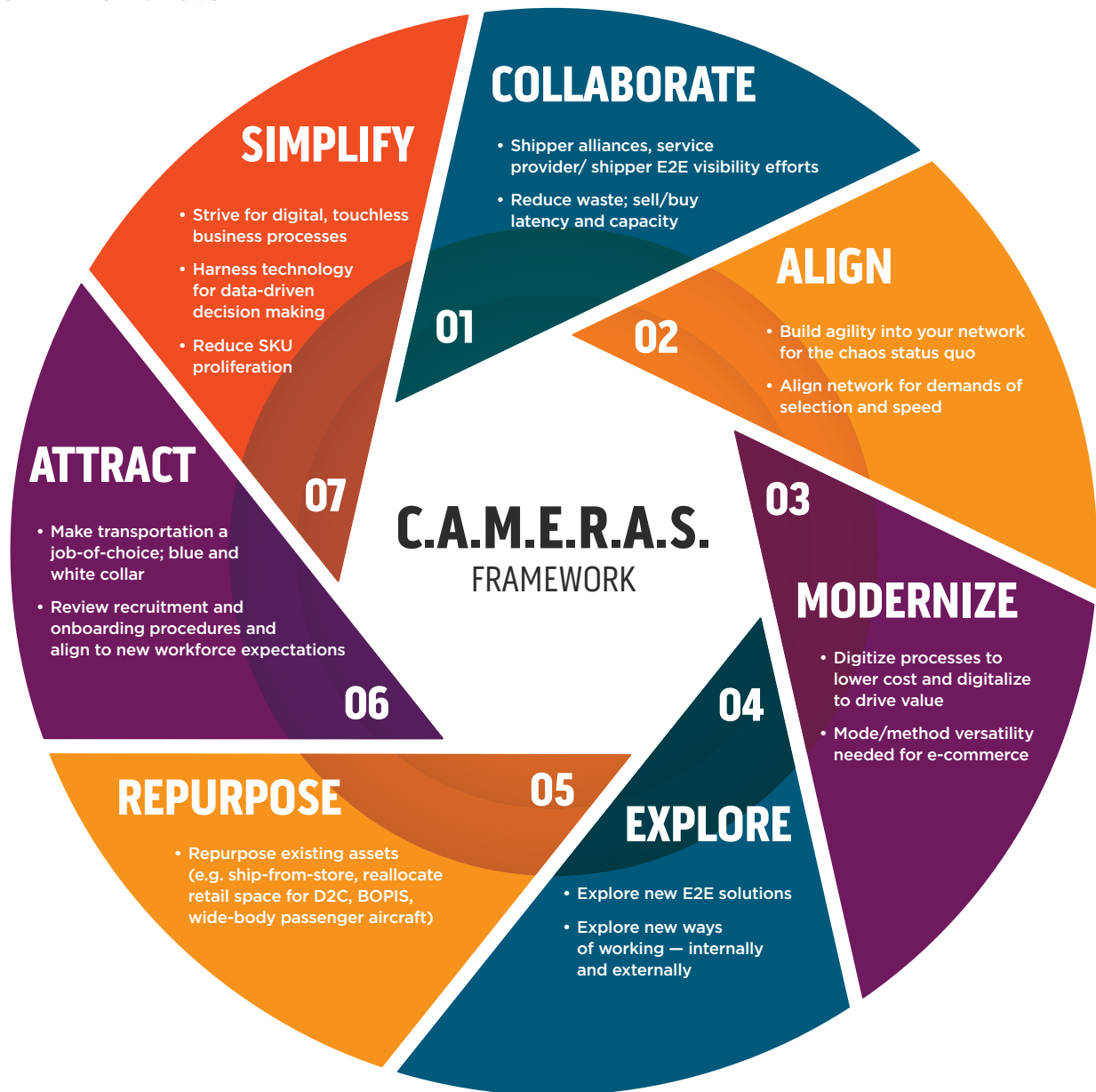
Figure 9. Five Themes Impacting Transportation



APPENDIX

Benchmark companies earn that designation when an assessment reveals they follow a critical mass of best practices. The following is a framework you might use to apply the five themes in your organization. It contains several best practices to consider.

Figure 10.
CAMERAS Framework



ENDNOTES

¹ M.C. Holcomb and K.B. Manrodt, “The Visible Supply Chain,” 2017.

² Stacy C. Davis and Robert G. Boundy, *Transportation Energy Data Book: Edition 38*, (2018).

³ M.C. Holcomb, C.A. Boone, and K.B. Manrodt, “28th Annual Study of Logistics and Transportation Trends: Find Your Digital Direction,” *Logistics Management*, (September 2019).

⁴ Jeroen Kraaijenbrink, “What Does VUCA Really Mean?” *Forbes* (December 2018), <https://www.forbes.com/sites/jeroenkraaijenbrink/2018/12/19/what-does-vuca-really-mean/#35054abd17d6>.

⁵ “Automated Vehicles for Safety,” National Highway Traffic Safety Administration, U.S. Department of Transportation (January 2020), <https://www.nhtsa.gov/technology-innovation/automated-vehicles-safety>.

⁶ “Reducing CO2 emissions from heavy-duty vehicles,” (European Commission on Energy, Climate Change, Environment: 2019), https://ec.europa.eu/clima/policies/transport/vehicles/heavy_en.

⁷ Wagner, I., “Electric vehicle charging stations and outlets in U.S. - March 2020,” Statista, March 3, 2020.

⁸ “How Many Gas Stations Are in U.S.? How Many Will There Be In 10 Years?” *247WallStreet*, February 16, 2020, <https://www.marketwatch.com/story/how-many-gas-stations-are-in-us-how-many-will-there-be-in-10-years-2020-02-16>.

⁹ “Average price of new Class 8 trucks in the United States from 2010 to 2018,” Statista (2020), <https://www.statista.com/statistics/937418/new-truck-average-price-in-the-united-states/>.

¹⁰ *Globalization in Transition: The Future of Trade and Value Chains*, McKinsey Global Institute, (January 2019).

¹¹ YellRobot.com, “Kroger Testing Autonomous Grocery Delivery Service in Houston,” *Robot News*, March 15, 2019, <https://yellrobot.com/kroger-nuro-autonomous-self-driving-grocery-delivery-houston/>.

¹² Jessica Haynes, “Domino’s Pizza expands self-driving delivery vehicle program,” MLive, January 30, 2019, https://www.mlive.com/business/ann-arbor/2018/03/dominos_pizza_expanding_self-d.html.

¹³ Tom Murphy, “CVS Health tests self-driving vehicle prescription delivery,” Pittsburgh’s Action News, May 28, 2020, <https://www.wtae.com/article/cvs-tests-self-driving-vehicle-prescription-delivery/32701065>.

¹⁴ “New NSC Analysis Finds Significant Digital Skills Gaps for Workers across Industries” (Washington, D.C.: National Skills Coalition, April 21, 2020).

¹⁵ “ATA Releases Updated Driver Shortage Report and Forecast,” *American Trucking Association*, July 23, 2019, <https://www.trucking.org/news-insights/ata-releases-updated-driver-shortage-report-and-forecast>.

¹⁶ “Standard Operating Procedure,” *Wikipedia*, July 14, 2020, https://en.wikipedia.org/wiki/Standard_operating_procedure.

¹⁷ M. Burnette, T. Stank and J.S. Meline, “New Product Initiative Best Practices”, 2017.

¹⁸ “Forecasting and Inventory Benchmark Study,” E2Open, 2019, https://pages.e2open.com/rs/809-EOG-429/images/E2open_2019_Forecasting_and_Inventory_Benchmark_Study_White_Paper.pdf.

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