About This Document

Given the fluid situation, this document is prepared to provide a snapshot of impacts of and responding strategies to the COVID-19 crisis, with the focus on supply chain and logistics management. Data are based on a review of literature published up to March 17, 2020, including managerial journals, industry reports, and relevant web resources. Content was analyzed to discern actions taken and industry opinions at the time of this review to get supply chain managers up to speed on how companies are responding to the COVID-19 crisis.

Contents

Impacts of Coronavirus (COVID-19) on Supply Chains ................................................................. 2
  Macro-Level Impacts: International & Domestic .............................................................................. 2
  Meso-Level Impacts: Supply Chain .................................................................................................. 3
  Micro-Level Impacts: Organization .................................................................................................. 6

Responding Strategies ...................................................................................................................... 7
  Supply Chain–Wide Responses ........................................................................................................ 7
  Node & Link–Specific Responses: Stop-Gap Measures to Preserve Supply Chain Functionality .... 11
  Supply and Supplier Management Responding Strategies ............................................................. 13
  Manufacturing Operations Responding Strategies ......................................................................... 14
  Transportation and Logistics Management Responding Strategies ............................................. 15
  Fulfillment and Distribution Management Responding Strategies ........................................... 16
  Retail Operations Responding Strategies ....................................................................................... 17

Strategies to Build Resilience for the Long Term ........................................................................... 18

References ................................................................................................................................................. 20
Impacts of Coronavirus (COVID-19) on Supply Chains

**Macro-Level Impacts: International & Domestic**

- **Macro-level impacts: International trade.** Policies intended to prevent further spread of the virus, which include travel restrictions and quarantines, have unintended consequences of disrupting international supply chains, suspending business operations and shrinking revenues (Onorato 2020).
  - Global effects of China’s slowdown through global value chains ($ million from a two percent reduction of China exports in intermediate inputs), with a significant drop in exports from China to the US. Overall, the most impacted economies will be the European Union (machinery, automotive, and chemicals), the US (machinery, automotive, and precision instruments), Japan (machinery and automotive), South Korea (machinery and communication equipment), Taiwan (communication equipment and office machinery) and Vietnam (communication equipment) (Berman 2020; Maritime Executive 2020).

- **Macro-level impacts: US Domestic**
  - **Domestic social distancing measures.** May contribute to absenteeism, labor shortages and interruptions (Kilpatrick and Barter 2020).
    - **Travel curfew.** On Monday, March 16, New Jersey became the first state to impose a curfew on non-essential, non-emergency travel between 8 p.m. and 5 a.m. (Cassidy 2020).
    - **Business curfew.** New Jersey also wants non-essential retail businesses to close at 8 p.m. (Cassidy 2020)
    - **COVID-19-related closures & People gathering ban.** COVID-19-related closures rapidly extended beyond schools, universities, and churches to bars, restaurants, and other public places. Connecticut, New Jersey, and New York on Monday 16 announced a ban on gatherings of more than 50 people, and similar bans are appearing elsewhere across the United States (Cassidy 2020).
  - **Workforce availability.** Across industries, the availability of white- and blue-collar labor is severely limited, and strict quarantines in key manufacturing hubs continue to take a toll (Betti and Hong 2020).
  - **Demand pattern impacts**
    - **Decrease in discretionary spending.** Examples: Luxury goods (Burnson 2020)
    - **Stockpiling/panic buying.** One of the most immediate impacts of the growing awareness of the virus has been stockpiling, particularly essential consumer goods such as toilet paper, hand sanitizer, cleaning supplies, and food cupboard items (Aylor, Gilbert, and Knizek 2020; Berthiaume 2020; Carroll 2020; Cassidy 2020; Redman 2020).
    - **Increase in online shopping.** E-commerce has boomed as consumers worldwide practice social distancing, self-quarantining (by choice or by government mandate) (Kapadia 2020), and as consumers eschew physical stores and crowded gathering places. Consumers are more likely to look for digital services that fulfill everyday needs beyond retail, including delivery of food and on-demand goods, per Marketwatch, which in turn could lead to an increase in business for delivery organizations, including Grubhub, Postmates and...
DoorDash, as well as for online grocers like Instacart and FreshDirect (Berthiaume 2020; Burnson 2020; Carroll 2020; eMarketer and BII 2020; Nielsen 2020; Nishimura 2020; Redman 2020).

According to Coresight Research, which delivers data-driven insights about the retail technology sector, more than 27 percent of consumers are already avoiding public areas or limiting their visits to venues like shopping centers. More than half (58 percent) said they would be likely to hold off on such visits if the outbreak spreads in the US (Nishimura 2020).

Consumer behavior threshold levels. A Nielsen investigation has identified six key consumer behavior threshold levels that tie directly to concerns around the COVID-19 outbreak. The thresholds offer early signals of spending patterns, particularly for emergency pantry items and health supplies, and we are seeing these patterns being mirrored across multiple markets. Key market statuses as of March 15, 2020 are: CHINA – level 5 (restricted living) moving into level 6 (living a new normal); ITALY – level 5 (restricted living); US – level 5 (restricted living); AUSTRALIA – level 3 (pantry preparation) (Nielsen 2020).

Supply chain node & link impacts. COVID-19 has affected supply chain dynamics across industries. Impacts depend on: (1) the extent to which your region or locale depends on exports from the impacted manufacturing areas; and (2) the inventory available across your supply chain to buffer potential disruptions (Aylor, Gilbert, Knizek 2020).

Government curfew-driven impacts. Restrictions on delivery times; shipping and receiving goods may become more than problematic (Cassidy 2020).

Supply and supplier-related impacts

Supply disruption: Long OTD lead-time & shortages. Companies have experienced supply chain challenges that have impeded their ability to get raw materials (Aylor, Gilbert, Knizek 2020). According to Anshul Acharya, vice president, management consulting, Publicis
Sapient, New York, organizations that have exposure in China typically see longer spans between demand signals and delivery, often with 30, 60, or 90-day delays (Onorato 2020). For a majority of US businesses, lead times of China-sourced components have doubled, and that shortage is compounded by the shortage of air and ocean freight options to move product to the United States—even if they can get orders filled (Berman 2020; Tanzi 2020).

- **Increased cost of supplies.** In the near term, the cost of supplies from China may increase, stemming from overtime and expedited freight costs, as well as from paying premiums to buy up supply and hold capacity (PwC 2020a).

- **Force majeure declaration.** Some supply contracts include force majeure clauses, which allow parties to delay or, in some cases, terminate performance of contracts because of a “superior force” making performance impractical or impossible. There is a surging interest in whether force majeure clauses can be invoked by suppliers. Companies dealing with suppliers in China will be confronted with legal defenses like force majeure clauses being invoked for non-performances, shielding such suppliers from legal and financial liability. A Chinese international trade promotion agency has reportedly started to issue force majeure certificates to more than 100 companies unable to meet contractual obligations amid the coronavirus outbreak (Aronow 2020; Brown and Tromper 2020; DHL 2020).

- **Price gouging from suppliers & sellers.** Panic buying can also lead to price gouging both in-store and online as supplies become more limited. Some third-party sellers on Amazon are experiencing price gouging from the Chinese suppliers who have been able to return to work. They’ve raised their prices, some by two to three times higher (Nishimura 2020). Meanwhile, there are also reports of price gouging on health-related products by third-party-sellers themselves, including on Amazon’s site (Redman 2020; Unglesbee 2020).

- **Production operations impacts: Production delays or stoppages.** Production operations can be labor intensive and/or sensitive to upstream supply shocks (Aylor, Gilbert, Knizek 2020). Manufacturers in China report operating at 50% capacity with 56% of normal staff (Berman 2020), resulting in production delays or stoppages because employees have not been able to come to work (Aylor, Gilbert, Knizek 2020).

- **Freight transportation and logistics impacts.** Companies have experienced supply chain challenges that have impeded their ability to execute logistics (Aylor, Gilbert, Knizek 2020).
  - **Capacity constraints**
    - Ocean and air cargo were affected immediately by the coronavirus-related cutbacks. That will certainly cause truckload freight later, but one factor propping rates up for the time being is a rush by truckers to resupply groceries and consumer packages goods (CPG) inventory in stores nationwide as consumers fill their pantries in reaction to school closures and the cancellation of many public events (Ames 2020).
    - Shortage of air and ocean freight options to move product from China to the United States. Reports of delays loading goods at Chinese ports, and delays in receiving orders from China (Berman 2020).
  - **Freight rate volatility.** Supply chain disruptions caused by global coronavirus shutdowns are likely to cause increased price volatility (Ames 2020).
  - **Air freight**
    - **Labor shortage causes congestion at Chinese airports.** The situation has been particularly acute at airport warehouses in Shanghai (DHL 2020).
Air freight capacity constraints to increase prices. Significant reduction in capacity of cargo holds of passenger planes due to transportation restriction and as a consequence airfreight costs have gone up (Berman 2020; Pittelli 2020). About 82 trans-Pacific sailings have been canceled into March, taking out around 198,500 TEU off the market. The large number of cancellations of both passenger and freighter flights combined with factory and logistics operations restarting in the coming weeks are expected to cause an air freight capacity shortage that could last until April. In total, more than 25,000 flights have been canceled per week so far, reducing air freight capacity by approximately 50%. The expected capacity crunch could lead to an increase of air freight rates by 300-400 percent, according to The Load Star (DHL 2020).

Ocean shipping freight. According to the World Trade Organization’s (WTO) services trade barometer, one of largest declines in trade through January has been container shipping and going forward that decline may continue with the spread of COVID-19 (Peters 2020).

Capacity shortage to increase prices: Backlog of empty containers & Shortage of containers for export bookings. Blank sailings reduce ocean freight capacity out of China. Blank sailing refers to the situation when a carrier cancels a scheduled stop at a specific port, or an entire route, for a certain vessel, usually due to low demand (DHL 2020). There is a significant drop in exports from China to the US, resulting in about half of all container ship traffic that would normally cross the Pacific from China to the US being cancelled in February. Examples: cargo vessel operators have canceled 40 sailings into the Port of Los Angeles for the period from mid-February through April 1; the Port Authority of New York and New Jersey expects at least 10 cancellations in March out of 180 arrivals scheduled; and Port Houston has seen six vessel sailings canceled in March. The cancelled sailings has disrupted the usual balance of trips between the US and Asia, with too few vessels arriving in L.A. to take the containers back to Asia, creating a large backlog of empty containers at the ports of Los Angeles/Long Beach waiting for vessels to evacuate them. At the same time, reduced US imports mean there are not enough containers in the Midwest to handle export bookings. Companies that are looking to export to Asia are competing in a very cutthroat environment to win space on the few ships they can find in the US, especially refrigerated containers (reefers) (Berman 2020; Pittelli 2020; Sasso 2020). Export rates from the US to Asia and export rates from the U.S. to Europe have received General Rate Increases (GRIs) due to the impact of the overall vessel capacity shortfall stemming from blanked sailings (Transplace 2020). At the same time, ocean carriers are pushing for export rate increases to compensate for container box repositioning costs (Pittelli 2020).

Labor shortage causes congestion at Chinese seaports & surcharge from ocean carriers. Yard congestion has also built up at ports across China due to the lack of port workers and truck drivers picking up containers from the ports (DHL 2020). Container lines Maersk, MSC, and ZIM have reportedly applied a surcharge of USD 1,000 for reefer cargo into these ports (Ningbo, Shanghai, and Tianjin) due to higher costs of re-routing, while not guaranteeing an exact delivery time (DHL 2020).

Congestion at US port terminal with reduced operating hours. Without vessel calls or cargo to handle, terminal operators in the US are cutting back hours to save on labor costs. Terminals in the Port of Los Angeles and Port of Long Beach have been cutting hours or closing altogether, and placing restrictions on the return of empty containers.
Some terminals aren’t accepting certain empty containers, while others will only accept empties if the driver also retrieves an import, known as a dual transaction (Ashe 2020). Los Angeles, Long Beach and Oakland have severe port congestion due to a lack of space for empty containers that are awaiting backhaul vessels to China and Asia. Terminal operations in LA/LGB are cancelling work shifts due to declines in through container volumes. These declines also impact container congestion and gate hours (Transplace 2020; Sasso 2020).

— **Empty container detention and daily chassis charges.** Detention penalties incurred for empty containers and daily chassis charges that may accrue as a result of current terminal conditions are creating restraint between ocean carriers and truckers. If unresolved, the Harbor Trucking Association (HTA) warned the beneficial cargo owners (BCOs) will be forced to bear the costs (Ashe 2020). Shippers are being penalized if drivers are unable to return empties within detention free time periods. Detention penalties range between $100 to $200 per container per day (Transplace 2020).

— **Ocean freight rates.** It is predicted ocean shipping lines may go into a “wait and see” pricing approach. When contract rates are reconsidered on May 1, moving freight out of China could cost more due to increased demand (Brumett 2020).

› **Trucking.** Trucking capacity in US still appears readily available (Cassidy 2020).

— **Driver HOS temporary relief.** US regulators are offering truck drivers unprecedented relief from hours of service (HOS) regulations – but only to those hauling emergency supplies. Trucking companies and drivers may want to obtain a statement from a shipper or consignee that their loads are COVID-19-related emergency goods, beyond just a bill of lading, before risking going over the 11-hour daily driving limit or 14-hour daily work limit (Cassidy 2020).

‖ **Retailing impacts**

› **Inventory level & online order delivery concerns.** Increase in online shopping, resulting in stockouts, especially in household staples categories. The concerns exist not only in terms of stock level but also in terms of last-mile deliveries (Berthiaume 2020; Burnson 2020; Carroll 2020).

**Micro-Level Impacts: Organization**

‖ **Revenue disruptions.** An impact on a company’s revenue through production slowdowns, difficulties in delivering goods or services to the market, significant drops in demand for the company’s goods or services, and delays in customers paying outstanding invoices (Brown and Trompeter 2020). One in six companies to lower revenue targets, by an average of 5.6%, ISM found in its Feb. 22-March 5 survey of 628 respondents, who were roughly split among U.S. manufacturers and service providers (Tanzi 2020).
Supply Chain Responding Strategies

Supply Chain-Wide Responding Strategies

- **Set up a cross-functional COVID-19 response team.** Establishment of a crisis response team is also one of the most common actions on the supply side (Craven et al. 2020; John 2020).

  - **Workstreams.** A few workstreams will be common for most companies: a) employees’ health, welfare, and ability to perform their roles; b) financial stress-testing and development of a contingency plan; c) supply-chain monitoring, rapid response, and long-term resiliency; d) marketing and sales responses to demand shocks; and e) coordination and communication with relevant constituencies (Craven et al. 2020).

- **Establish and mobilize a “Command Centers” (aka “War Rooms”) to evaluate, monitor, and address supply chain vulnerabilities.** Establish a “war room” staffed with the right talent with supply chain experts empowered with clear c-suite mandate and decision rights to make supply chain decisions to maximize supply chain performance during this period of disruption can be an effective tactic. This is where key functions meet and work daily, using visual management techniques for critical cross-functional information exchange. This team will drive required actions while monitoring the evolving risks daily. In addition, be sure the team balances a quick response with a long-term sustainable approach (Aylor, Gilbert, Knizek 2020; Collie et al. 2020; Deloitte 2020; Kilpatrick and Barter 2020; Reeves, Lang, and Carlsson-Szlezak 2020).

- **Risk assessment and preparedness**

  - **Conduct end-to-end supply chain risk assessment and prioritize critical focus areas**

    - **Develop visibility to supply chain.** Develop visibility to the entire value chain across primary, secondary, and even tertiary players. Assess all SKUs and inputs for geographic risks. Who makes critical parts? Are there alternate sources? What is the supplier’s inventory status? It is important to understand not only your internal supply chain but also...
the supply chain of your suppliers and contractors to determine whether they might be impacted and could be at risk (Avetta 2020; Aylor, Gilbert, Knizek 2020; Betti and Hong 2020; Burnson 2020; Burt 2020; Collie et al. 2020; EY Global 2020; PwC 2020a; Sanders 2020).

— **Set priority.** Carefully segment the entire product and customer portfolio based on margins, lead times, and criticality. Not all are of equal importance or vulnerability. Create a matrix based on these two dimensions identifying customers, products, and sources of supply that are most critical and most vulnerable within each quadrant. Set priorities. Which customers get served first? Which suppliers are critical? Which components have longest lead times? (Collie et al. 2020; Sanders 2020).

— **Useful resource: COVID-19: Navigator by PwC.** PwC has created the COVID-19: Navigator, an online tool (available at [https://www.pwc.com/us/en/library/covid-19/response-navigator.html](https://www.pwc.com/us/en/library/covid-19/response-navigator.html)) that helps companies assess the potential impact to their business and gauge readiness to respond to disruption created by the coronavirus pandemic. **How it works:** The digital tool contains 3 sections of questions that will help you understand where your company stands as you respond to COVID-19 in the areas of: crisis management and response; workforce; operations and supply chain; finance and liquidity; tax and trade; and strategy and brand (PwC 2020b).

— **Scenario planning.** Deploy scenario-planning techniques to systematically evaluate the end-to-end value chain, where different demand environments are considered across the entire supply chain, and establish action plans and be able to deploy rapidly (Betti and Hong 2020; PwC 2020a; Sanders 2020). While different organizations face unique risks, companies should develop plans for both optimistic and conservative situations. In the case of COVID-19, this is defined as: (1) **Optimistic scenario:** COVID-19 is contained by April or May, with normalcy returning to global operations through the end of Q2. (2) **Conservative scenario:** COVID-19 remains prevalent, with continued impacts lasting into Q4 (Onorato 2020). Examples: Cisco regularly models scenarios for different global and economic conditions, and is assessing scenarios for various outcomes, including long-term implications (Cisco 2020).

— **Constantly reframe efforts.** In China, some of the fastest-recovering companies proactively looked ahead and constantly reframe efforts in crisis planning and response, recovery strategy, and post-recovery strategy (Reeves et al. 2020).

— **Practice the plan.** This is where roundtables or simulations are invaluable. Companies can use tabletop simulations to define and verify their activation protocols for different phases of response (contingency planning only, full-scale response, other) to ensure that, in the event, the actions needed to carry out the plan are fully understood and the required investment readily available (Craven et al. 2020).

— **Leverage technology.** Companies should look at how new tools and technologies can provide greater intelligence. For example, **risk evaluation tools** that make use of machine learning can find patterns that can indicate risks or opportunities in macroeconomic, geopolitical and global health, exchange rate and other data; and **landed-cost tools** that can also rapidly model alternate supply and transportation scenarios, such as rerouting or going to an alternate source of supply (PwC 2020a).
- **Risk monitoring.** Given the fluid nature of the ongoing impact of the coronavirus pandemic on global supply chains, it stands to reason that things are changing—and will continue to change—on a daily basis, if not more frequently (Berman 2020).
  - **Continuous monitoring of affected areas.** In a crisis situation like COVID-19, it is necessary to use the internet to connect the various supply chain information systems together. That creates a basic control tower, which reveals which problems the company should tackle first. Companies should maintain a “control tower” for supply chain mapping and risk assessment as scenarios evolve (Avetta 2020; Aylor, Gilbert, Knizek 2020; Roodenburg 2020).
  - **Maintain continuity/contingency plan.** Keep business continuity/contingency plans and protocols up-to-date for uninterrupted operations (Avetta 2020).

- **Workforce protection and planning**
  - Companies should first and foremost act to ensure the safety and well-being of employees and their families (Avetta 2020; Aylor, Gilbert, Knizek 2020; Collie et al. 2020; Onorato 2020).
  - After worker safety is secured, companies can alter outcomes by planning where and when employees will work in order to maintain operations (Avetta 2020; Aylor, Gilbert, Knizek 2020).

- **Demand sensing.** The economic recovery would be a “U-shaped” recovery, in which businesses see lower levels of demand for a significant period (most said seven-plus months), and then demand roaring back. Effective demand sensing will be a critical capability (Aronow 2020).
  - S&OP SKU-level demand signal estimates by macro scenario (Craven et al. 2020).
  - Seek out and use sources of demand data that go beyond historical demand, as demand will be very different from historical patterns (Burnson 2020). Traditional demand forecasting relies on time series techniques which create a forecast based on prior sales history. However, past sales can be a poor predictor of future sales considering real-world events (EY Global 2020). Use technologies and advanced analytics to sense in real time (Gandhi 2020). Example: One of the leading global beverage companies has adopted Internet of things (IoT) and visual recognition technology to sense demand in coolers installed in convenience stores, restaurants and supermarkets. With such technologies in place, the company can increase visibility of channel inventory and better respond to an event like the coronavirus outbreak even if distributors cannot provide current-state forecast (EY Global 2020).

- **Inventory monitoring and management**
  - **Inventory monitoring.** Companies must closely monitor short-term and long-term demand and inventory, including components and sources, to accommodate production loss in the wake of factory closures and economic slowdown. Companies should differentiate how they hold inventory, using a multi-echelon optimization approach to prevent shortages (Aylor, Gilbert, Knizek 2020; Onorato 2020). Stock critical inventory, increase inventory buffers to insulate against vulnerabilities (Aylor, Gilbert, Knizek 2020; Betti and Hong 2020).
  - **Create recovery plan early and differently for different locations.** As areas in impacted regions recover, it is important to conduct supply chain and inventory planning for the recovery phase early (Aylor, Gilbert, Knizek 2020). Considering the time it takes to formulate, disseminate, and apply new policies in large companies, recovery planning needs to start while you’re still reacting to the crisis. Recovery strategy should be adapted for different location to
reflect regional differences in expected recovery speed, consumer sentiment and needs (Reeves et al. 2020).

- **Close communication and engagement with supply chain members**
  - **Reach out and maintain communication with suppliers.** Reach out to your suppliers and find out how they are being affected. Try to get an understanding of how prepared key suppliers and other stakeholders are for an unexpected event. Staying in close communication and offering suppliers support to work through any problems is key to mitigating the threat. Talk daily with suppliers in affected areas; get weekly updates and critical information from overseas suppliers to understand current factory status and operational plans. Getting visibility to the status of your inventory at the supplier location, supplier production schedules, and supplier shipment status will help you to predict supplier shortages and respond accordingly. The information gives you time to plan for both order fulfillment and shipping costs (Brumett 2020; Burnson 2020; Burt 2020; Hudecheck et al. 2020; Kilpatrick and Barter 2020).
  - **Maintain contact with carriers and logistics service providers.** Maintain contact with logistics providers to ensure you know how and where your business will be affected (Burt 2020).
  - **Customer communication and engagement**
    - **B2B transparency: Scenario-based risk communication.** Late deliveries to customers (e.g. due to plant delays or stoppages, supply shortages, longer lead time) could strain or end existing customer and supplier relationships. Companies should evaluate the potential impact any such delays or disruptions could have on these relationships and keep key customers informed of the situation (Brown and Trompeter 2020; Craven et al. 2020).
    - **Customer outreach.** Customer communication regarding COVID-practices, fact-based reports on issues and situation communication (Craven et al. 2020). Consumers will be seeking greater assurance that the products they buy are free of risk and of the highest quality when it comes to safety standards and efficacy, particularly with respect to cleaning products, antiseptics and food items. Manufacturers, retailers and other related industry players should clearly communicate why their products and supply chains should be trusted (Nielsen 2020).
    - **Remote support capability.** Examples: Cisco provides remote support to sites that do not permit physical access to customer or partner site (Cisco 2020).
### Node & Link-Specific Responses: Stop-Gap Measures to Preserve Supply Chain Functionality

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Create transparency on multi-tier SC</td>
</tr>
<tr>
<td></td>
<td>Determine critical components, and determine origin of supply</td>
</tr>
<tr>
<td></td>
<td>Assess interruption risk and identify likely Tier 2+ risk</td>
</tr>
<tr>
<td></td>
<td>Look to alternative sources of suppliers in severely affected regions</td>
</tr>
<tr>
<td>2.</td>
<td>Analyze available inventory</td>
</tr>
<tr>
<td></td>
<td>Estimate inventory along the value chain, including spare parts/raw manufactured stock</td>
</tr>
<tr>
<td></td>
<td>Use after sales stock as bridge to keep production running</td>
</tr>
<tr>
<td>3.</td>
<td>Optimize production and distribution capacity</td>
</tr>
<tr>
<td></td>
<td>Assess impact on operations and available resource capacity (mainly workforce)</td>
</tr>
<tr>
<td></td>
<td>Ensure employee safety and clearly communicate with employees</td>
</tr>
<tr>
<td></td>
<td>Conduct scenario planning and assess impact on operations based on available capacity</td>
</tr>
<tr>
<td>4.</td>
<td>Estimate realistic final customer demand</td>
</tr>
<tr>
<td></td>
<td>Work with S&amp;OP to get demand signal to determine required supply</td>
</tr>
<tr>
<td></td>
<td>Leverage direct communication channels with direct customer</td>
</tr>
<tr>
<td></td>
<td>Use market insights/external databases to estimate for customer’s customers</td>
</tr>
<tr>
<td>5.</td>
<td>Leverage available logistics capacity</td>
</tr>
<tr>
<td></td>
<td>Estimate available logistics capacity for air/sea/road/rail</td>
</tr>
<tr>
<td></td>
<td>Accelerate customs clearance</td>
</tr>
<tr>
<td></td>
<td>Change mode of transport and pre-book air/rail capacity given current exposure</td>
</tr>
<tr>
<td></td>
<td>Collaborate with all parties to jointly leverage freight capacity</td>
</tr>
</tbody>
</table>

Source: BCG, Craven et al. (2020)
<table>
<thead>
<tr>
<th><strong>Demand Risk</strong></th>
<th><strong>Service Risk</strong></th>
<th><strong>Supply Risk</strong></th>
<th><strong>Labor Risk</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop best and worst-case demand scenarios, taking into account the possibility of both the sudden lack of demand and the demand spikes due to stockpiling.</td>
<td>Determine if increasing inventory makes sense to buffer future disruption.</td>
<td>Leverage Tier 1, 2 and 3 supplier visibility to its fullest extent.</td>
<td>Develop readiness checklist for office, factory workers should COVID-19 appear.</td>
</tr>
<tr>
<td>Identify and track demand triggers.</td>
<td>Develop an allocation plan that can be immediately activated.</td>
<td>Leverage alternative locations and suppliers.</td>
<td>Ensure proper employee communication plans and additional HR support are in place.</td>
</tr>
<tr>
<td>List products that can be stopped to make capacity for others.</td>
<td>Perform customer contract reviews to understand possible penalties.</td>
<td>Determine crisis response team with decision-making authority or fast access for necessary approvals.</td>
<td>Determine access to alternate sources of labor.</td>
</tr>
<tr>
<td></td>
<td>Communicate inventory runout to executive teams.</td>
<td></td>
<td>Prep for ability to work from home where able.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Transportation Risk</strong></th>
<th><strong>Communication</strong></th>
<th><strong>Financial Risk</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Track information to understand which airports and ports could be at risk of disruption.</td>
<td>Develop key messages, instructions and response information for employees and stakeholders.</td>
<td>Facilitate revenue/cost trade-off decision making based on the changing situation.</td>
</tr>
<tr>
<td>Determine if freight should be moved closer to customers now to hedge against future closures or constraints.</td>
<td>Designate a point person or team to communicate supply chain impacts and responses.</td>
<td>Fast track approval process for emergency spending needs.</td>
</tr>
<tr>
<td>Consider possible spike in freight cost should capacity suddenly become unavailable.</td>
<td>Implement plan to regularly update.</td>
<td>Develop plan to mitigate risk or avoid penalties.</td>
</tr>
</tbody>
</table>
Develop a near-term supply continuity plan at the component level. An effective plan would likely use a combination of levers including first claim on supply, buffering of inventory, shifting sourcing to similar facilities in other geographies, scouting of alternative sources, and entering into ad hoc negotiations (Collie et al. 2020).

Ensure redundancy with critical vendors. Connect with critical suppliers, find backup suppliers for key components, and secure additional critical inventory and capacity (Avetta 2020; Aylor, Gilbert, Knizek 2020; Betti and Hong 2020; Kilpatrick and Barter 2020; Webb 2020).

Consider troubled vendor programs. Distressed vendors may face daunting operational and financial challenges that threaten their continuing viability. Many manufacturers have developed troubled vendor programs to provide the liquidity to support critical, or sole source products integral to their manufacturing processes until alternative vendors can be located (Rubenstein et al. 2020).

Adjust capacity and geographic sourcing in response to evolving conditions.
Understand and activate alternate sources of supply. For those companies that have multi-sourced key inputs, it is important to move quickly to activate secondary supplier relationships (Kilpatrick and Barter 2020).

Consider back up or alternative suppliers/sourcing options. Assessment of future demand should drive adjustments to capacity and sourcing. Identify and establish relations with alternative suppliers that are less affected by the crisis to diversify supply chain and safeguard against shortages, especially for products with longer supply cycles. This includes potentially shifting geographic sourcing or sourcing from new geographies (Avetta 2020; Aylor, Gilbert, Knizek 2020; Cisco 2020; Deloitte 2020; Hudecheck et al. 2020; Onorato 2020; Onorato 2020; PwC 2020a).

Consider substitute products. Identify segments that have easy access to substitutes and alternative sources of supply, as well as consider slight product modifications that may allow substitution in components and where there are good sources of supply (Burt 2020; Sanders 2020).

Aggressively evaluate near-shore options to shorten supply chains and increase proximity to customers (Betti and Hong 2020). Example: 3M has mitigated major supply chain disruptions amid the virus outbreak by sourcing materials for its face masks from regional suppliers instead of relying on distant providers (Hockett 2020).

Monitor supplier financial health. The financial health of suppliers needs to be carefully monitored moving forward (Burt 2020). Tier 2 and beyond suppliers are often the most impacted by rapid economic downturns due to low working capital. Small suppliers may be particularly vulnerable if the crisis is prolonged, as they often have far fewer cash reserves to carry them through the disruption (Aronow 2020; Gandhi 2020).

Review relevant force majeure provisions. Considering the COVID-19 outbreak could result in the suspension of operations, businesses that rely on a complex network of suppliers and vendors need to understand the inclusions of a force majeure declaration. Force majeure is a legal doctrine under which a contractor may be relieved from liability for non-performance beyond their control. These provisions vary greatly depending on the way they have been drafted (Avetta 2020).

Manufacturing Operations Responding Strategies

Confirm short term demand-supply synchronization strategy. When demand falls significantly, companies must quickly determine how they will respond from a sales and operations planning perspective. Some companies may choose to keep running and build inventory, absorbing fixed costs and preparing for the rebound, while others are better off reducing production (Kilpatrick and Barter 2020).

Closure, reroute production & switch production processes. Companies should have plans on how to initiate a closure and how to reroute production to other locations within your network, as well as evaluate possibility of gearing up capacity or switching production processes of similar lines to much needed items (Kilpatrick and Barter 2020; Sanders 2020).

Example: Toronto based lotion manufacturer quickly switched production from lotion to hand sanitizer (Sanders 2020).
Examples: Toyota, Ford, and Ikea are among the other major businesses that are either idling their production units or reducing operations. Fiat Chrysler advised they are now looking into shutting down a European manufacturing plant because supply from Chinese suppliers has all but diminished in the wake of the outbreak. Ford’s Valencia assembly and engine facility in Spain has already temporarily shut down beginning Monday, March 16; and Ford’s manufacturing facilities in Cologne, Craiova, Romania and Saarlouis, Germany will shut down Thursday, March 19 (Avetta 2020; Putre 2020).

- **Ramp up alternative capacity.** Consider ramp up back up or alternative manufacturing capacity that is already in place (Aylor, Gilbert, Knizek 2020). Examples: Cisco brings up additional manufacturing capability in other regions (Cisco 2020).

- **Focus on production scheduling agility.** Prioritize what products you will produce in the event of raw and direct material inventory shortages, especially where a component part may be used in multiple finished goods. With expected supplier and demand disruption, be prepared to refine production schedules based on the inventory available, changing demand and what you are capable to build, while at the same time, ensuring that you do not use component parts that put your most important products at risk of stock-out. Traditional planning and scheduling processes, and frozen periods to allow efficient production execution, are unlikely to work well in this environment (Kilpatrick and Barter 2020).

- Placing emphasis on driving production efficiency, strong yield, and high first pass quality is even more important as many companies have reduced capacity utilization due to staffing limitations (EY Global 2020).

- Leverage advanced manufacturing technologies to become more resilient by improving sensing and pivoting capabilities (Betti and Hong 2020).

---

**Transportation and Logistics Management Responding Strategies**

- **Mode and route modification.** For their most important supply and distribution channels, companies should identify alternative lanes and modes (Aylor, Gilbert, Knizek 2020). Develop contingency plans to prepare the potential shut down of additional transportation and logistics (T&L) modes or channels. Build T&L flexibility through adding additional modes and rerouting transportation around affected. In some cases, companies are looking at alternate routes to get product out of China (e.g., Rail to the port of Rotterdam and then Ocean to North America) (Aylor, Gilbert, Knizek 2020; Cisco 2020; Kilpatrick and Barter 2020).

- **Strategies for urgent orders.** If air freight is appropriate for the most urgent orders, explore using secondary airports and indirect routings to gain access to space. Small, frequent shipments will be easier to move than larger lots. For a faster ocean transit time to the interior of the US, terminate ocean shipments on the West Coast and have your freight transloaded from containers into trailers there. If your company also sells Asian manufactured goods in Europe, consider switching that cargo from ocean to rail. This can cut transit time by as much as ten days, while also avoiding any cross-province trucking delays (Pittelli 2020).
Rate & capacity planning

- **Immediate tactics.** To have your company’s ocean cargo move at 2019/2020 rate levels, request a one-month extension on the current ocean contracts. Or, ask your freight forwarder to add your company on to the forwarder’s current season NAC (Named Account) contracts. If space becomes a premium, an internet-based freight marketplace can provide guaranteed space, albeit at spot market pricing. Explore some of these new applications now in order to have a contingency plan in place (Pittelli 2020).

- **Secure future services and prepare for the short-term recovery phase in impacted regions.** With significant port congestion, a significant decrease in air freight capacity, and truck driver shortages, there is a significant backlog in logistics that will take some time to resolve as logistics operations gradually come back to normal. Moreover, carriers are projecting large rate increases for the 2020/2021 season. Once the cargo supply returns to normal, accumulated demand may cause ocean import rates to spike right before the start of the traditional Trans-Pacific rate negotiation season. Companies need to work to secure capacity with their logistics partners. It is important to conduct supply chain and inventory planning for the recovery phase early and lock-in transportation and logistics capacity as needed. Companies that plan for the manufacturing surge can line up shipping early and lock in the best rates. The earlier you can solidify routing, the better your pricing may be (Aylor, Gilbert, Knizek 2020; Brumett 2020; Kilpatrick and Barter 2020; Pittelli 2020).

**Fulfillment and Distribution Management Respond Strategies**

- **Reroute orders fulfillment locations.** Finding alternate locations for order fulfillment (Deloitte 2020). Examples: Amazon could weather the temporary closure of a building or two by automatically rerouting orders to other facilities. The company uses a version of that plan when facilities are overwhelmed with orders during the peak holiday shopping season, diverting them from the overburdened facility to others nearby until the backlog clears. Amazon has also used the system keep operations running during natural disasters such as flooding and tornadoes (Bloomberg 2020).

- **Prioritize/allocate available supply for fulfillment.** With expected inventory shortages, it is important to confirm customer and product priorities, and to agree on the strategy by which inventory will be allocated in times of scarce supply. Strategies may range from “first come first serve” to “fair share” (proportional to expected volume) to “differentiated” based on strategic importance (e.g. reallocate inventory across sales channels to meet the most urgent needs of your most valued customers) (Aylor, Gilbert, Knizek 2020; Gandhi 2020; Kilpatrick and Barter 2020). In defining an optimized order fulfillment plan for finished goods that are at risk of shortage. Companies must understand the main tradeoffs across potential penalties and reputational damage, strategic priorities, the risk of losing market share, and margin realization (price increase) opportunities (Collie et al. 2020). Examples: Cisco uses a data-drive approach to carefully prioritize/allocate the available supply for fulfillment (Cisco 2020).
Manage demand volatility. In the short term, halting promotions, prioritizing products, and creating inventory reserves are strategies to help manage demand when supply is limited (Onorato 2020).

Physical retail store operations

- **Temporary store closures.** Examples: Nike, Abercrombie & Fitch, Under Armour (Binns 2020).
- **Reduce store operating hours.** Examples: Walmart (took effect Sunday, March 15), smaller specialty chains such as Natural Grocers, regional powerhouses such as Publix Super Markets, Texas grocer H-E-B (Binns 2020; Wilson 2020; Redman 2020)
- **Non-contact pick-up zone.** Many convenience/discount/grocery stores in the UK have created ‘pick-up zones’ for customers to collect products without human-to-human contact and this is a logical solution for retailers within the UK who do not have online capabilities (Carroll 2020).
- **Instigated restricted sales on certain products in high demand.** Examples: Walmart, Texas grocer H-E-B, Publix, Wegmans, Stop & Shop, Target (Carroll 2020; Redman 2020; Unglesbee 2020).

E-retailing. A surge in demand for e-retailing could overwhelm logistics providers and workers, which might require ecommerce companies to revisit their strategies for order fulfillment and delivery (eMarketer and BII 2020).

- **Unattended, contactless delivery option.** Offer “contactless” delivery options to minimize risk. Contactless delivery generally means that those ordering food or other supplies can get them delivered without coming face-to-face with their delivery driver. Examples: Amazon, Instacart, Postmates, Doordash (Berthiaume 2020; eMarketer and BII 2020; Salaky 2020).
- **Tamper-evident packaging seal.** Chipotle have gone even further, offering a new, tamper-evident packaging seal to help ensure food is untouched during delivery (Salaky 2020).
- **Monitor and prevent price gouging.** Retailers have responded with assurances against price gouging. Examples: Walmart online is taking a firm stance related to the potential for price gouging by third-party sellers; Amazon establishes policy prohibits price-gouging and the company says it actively monitors third-party sellers and removes violators (Berthiaume 2020; Onorato 2020; Redman 2020; Unglesbee 2020).
- **Increase warehouse and logistics workforce.** To address absenteeism at the facility and online demand spikes, instead of closing facilities, Amazon announced plans to hire an additional 100,000 full-time and temporary workers and raise pay in the US and Canada by $2 an hour through April. The additional warehouse workers will focus primarily on stocking and shipping of essential goods (Bloomberg 2020; Kapadia 2020).
Moving toward more comprehensive proactive approaches to risk management

- **Ensure buy-in for future risk management capability.** Look to build resilient supply chains by securing budget for risk management tools or capabilities, which is easiest in the immediate aftermath of a major disruption. Focus on digital development, e.g. digitize process and tools to integrate demand, supply, and capacity planning (Burt 2020; Webb 2020).

- **Evolve through learning.** Responses to dynamic crises like Covid-19 put a premium on evolvability. When the crisis subsides, efforts should be made not to squander a valuable learning opportunity. Even while the crisis is unfolding, responses and impacts should be documented to be later reviewed and lessons distilled, e.g. converting war room into a reliable risk management process, and codify the processes and tools created during the crisis management as formal documentation. While they are likely become obsolete over time, doing so makes it possible to iterate and learn towards more effective solutions (Craven et al. 2020; Reeves, Lang, and Carlsson-Szlezak 2020).

- **Establish a supply chain risk function** tasked with developing understanding of supply chains more deeply and in more dimensions, and proactively assessing potential threats (Collie et al. 2020; Craven et al. 2020; PwC 2020a).
  - Define cost-efficient risk mitigation strategies (Collie et al. 2020)
  - Outline contingency plans by crisis type (Collie et al. 2020)
  - Preapprove a response protocol and chain of command (Collie et al. 2020)

- **Implement digital and automated manufacturing capabilities paired with strong manufacturing excellence.** Leverage automation and IoT solutions for smart manufacturing operations to mitigate reliance on labor intensive processes. Automated manufacturing capabilities will enable a company to run a manufacturing operation using interchangeable personnel and reduces labor requirements (EY Global 2020).
- **Evaluate and adjust procurement category strategic priorities.** An agile procurement operations system enabled by various technologies and factoring category strategic priorities across variables such as cost, quality, delivery, innovation, etc. will also help drive resiliency (EY Global 2020). Gain visibility into supply origin and embed traceability in contracts (Collie et al. 2020)

- **Invest in more collaborative and agile planning and fulfillment capabilities.** These capabilities are extremely important for business performance even in normal business conditions and they increase the supply chain resilience in pandemic events like the coronavirus outbreak (EY Global 2020).
References


Avetta. 2020. “Supply Chain Lessons Learned from The Coronavirus and SARS Outbreaks.” Supply Chain 24/7, March 2.


