

A Cross-Industry Study Identifying Enabling Factors of Supply Chains that Successfully Responded to COVID-19

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Abstract

With COVID-19 impacting the economic, social, and political aspects of the world, supply chains of companies are repurposing their products to aid in fighting the pandemic with certain enabling factors that allow companies to respond and transition from typical production to meeting the exceptional needs of the medical industry. We research the challenges to a company's supply chain while shifting to needed products. We examine how or if the companies are utilizing their current supply chain to create a new supply chain for scarce healthcare products. Additionally, the logistics of being able to distribute the new products to the public, in terms of abiding by safety and sanitation regulations were explored. Furthermore, we examine how these companies plan on changing their supply chain and factories back to their original products once business returns to stable and level conditions. Based on fact-finding, we were able to determine whether companies were successful in their mission to provide resources to the medical industry during this time of crisis, and why that is.

Keywords

Supply Chain, Coronavirus, Healthcare Industry

1. Introduction and Background

In late 2019, a small cluster of fatal pneumonia cases arose in Wuhan, China. The cause was a novel strain of coronavirus. Patients had flu-like symptoms with varying degrees of respiratory distress. On January 9, 2020, Chinese researchers shared the genome of the virus now called SARS-CoV-2 (Rabi et al., 2020). The disease caused by the virus has been termed the coronavirus disease 2019 or COVID-19. Shortly afterward, the World Health Organization (WHO) declared COVID-19 to be a public health emergency. By March 11, 2020, the WHO characterized COVID-19 as a pandemic. COVID-19 quickly spread to many countries and endangered many lives and business' supply chains. In response to these unprecedented circumstances, governments globally responded to the pandemic by implementing stay-at-home orders to residents. Businesses were subdivided into essential and non-essential, and most businesses were forced to close stores temporarily. As the demand for non-essential goods decreased and the need for medical equipment increased, companies from different sectors began repurposing their products to serve the healthcare workers in their communities. Six industries that pivoted their supply chain are food, alcohol, technology and medical, automotive, and retail. Throughout these industries, enabling factors that allowed companies to respond effectively to changing markets are: a large supply chain network, a global presence, the ability to repurpose inventory on hand, and financial stability.

The paper is organized into six main sections, each overviews a specific industry: food, alcohol, technology and medical, automotive, and retail. Each section details specific examples of how that industry responded to the pandemic.

2. Industries Impacted

2.1 Food Industry

Few industries were considered essential amidst the pandemic; the food industry was one of them. While most industries halted, the food supply chain was pressured in unprecedented ways. One primary disrupting factor affected

supply chains was changes in consumer buying habits (Dubner & Lapinski, 2020). According to a survey conducted by Pymts.com, eating out in the United States declined by 52.3% between the week of March 6, 2020, and March 17, 2020 (*Navigating the COVID-19 Pandemic*, 2020). Between February 19, 2020, and March 13, 2020, visits to bulk grocery stores increased by 39% (*Understanding The Impact of COVID-19 With Foot Traffic Data*, 2020). Additionally, panic-buying and hoarding caused shortages of certain foods, such as milk, eggs, and bread (Dubner & Lapinski, 2020). When the stay-at-home orders were issued, the commercial markets collapsed as demand for commercial goods declined dramatically. At the same time, demand in retail markets faced substantial increases in demand (Bruno, Sexton, & Sumner, 2020). The amount of food being produced remained constant, but how the food was being distributed, or not distributed, changed significantly. In some cases, farmers adapted by circumventing traditional supply-chains. The primary enabling factors allowing this transition were technology and inventory.

Meat processing plants across the United States were forced to close due to the spread of COVID-19, resulting in a 25% reduction in pork and a 10% reduction in beef available (Lucas, 2020). With less supply available in grocery stores, consumers looked to new markets to fulfill demand. In North Carolina, farmers who traditionally supplied commercial markets started selling directly to consumers. In response to the pandemic, NC Choices, a program of the Center for Environmental Farming Systems and NC Cooperative Extension, developed a website, MeatSuite.com, to help bridge the gap between farmers and consumers (Cornell Cooperative Extension, 2020). Similarly, the University of Missouri set up a website called Missouri Food Finder, where consumers can connect directly to farmers who have produce and/or meat to sell (Katherine, 2020). This technology enabled local farmers, who usually sold to restaurants, to connect directly to consumers. They sold the same inventory, but they utilized technology to change their customer base. Other parts of the supply chain adapted in different ways. Enabling factors such as inventory and expansive market connections allowed some commercial suppliers to pivot and supply to retail markets instead. One example of this is Sysco.

Sysco is a leading restaurant supplier in the United States. Sysco has one of the world's largest privately-owned fleets and warehouse networks. This enables them to adapt to changes quickly. With decreased demand in commercial markets, Sysco diverted supply chain resources to help fulfill increased demand in retail. Additionally, Sysco helped restaurants pivot their business to meet changing market needs. They assisted small businesses that were unacquainted with fulfilling to-go orders, change their business models, and have helped some restaurants set up pseudo grocery store/retail portions to create new revenue streams (Hourican, 2020). Sysco was able to promptly provide any cleaning supplies and take-out supplies for to-go orders since they had the inventory on hand or have suppliers who could provide it quickly. Sysco is a large global company that already had the business expertise to help restaurants make these changes. Their strong relationships with their customers allowed them to understand better their customers' needs. Even with assisting their customers, Sysco still had too much inventory. In response, Sysco supplied food to grocery stores and sold directly to consumers (Hourican, 2020). In April 2020, Sysco launched a new initiative called Sysco@home, which allows consumers to buy bulk products and pick them up at warehouses (Sysco, 2020). Sysco successfully found ways to redirect their inventory to fulfill changing market needs.

In general, the food supply chain in the United States is optimized for efficiency, with little redundancy built-in. With the COVID-19 pandemic, changes in demand were so widespread, it shocked the grocery system temporarily and caused a massive upset in the commercial industry (Bruno, Sexton, & Sumner, 2020). In response, companies have innovated and pivoted their business to meet new demands. Farmers are recognizing the difficulty consumers are facing shopping at retail markets and are offering to sell directly. Food suppliers like Sysco are applying resources to help minimize disruption in the retail supply chain. Enabling factors like an extensive logistical network, and the close relationships they have developed with their customers has helped Sysco to pivot their business to meet customer demands. Other large companies are able to pivot due to similar factors; within the alcohol industry, having a well-established business and logistical network made it easy to transition into creating new products.

2.2 Alcohol Industry

With a high demand for alcohol-based sanitizers due to the sudden spike in COVID-19 cases in the United States, the alcohol industry has shifted the supply chain focus to help hand sanitizer producers meet the demand. Many distilleries and wineries repurposed their current resources and worked with the government to get approval to manufacture and sell sanitizers. As hand sanitizers are generally composed of alcohol mixed with hydrogen peroxide, glycerol, and water, the transition for alcohol manufacturers to start producing hand sanitizers is not very complicated.

E. & J. Gallo Winery, one of the leading alcohol manufacturers in the United States with a net worth of \$3.8 billion, is an example of this. Gallo has thrived as alcohol sales have increased by 55% during the nationwide stay-at-home order, as people no longer have the option to go out to bars (Polakovic, 2020). At the Brandy Plant, the Spirits Making department transformed one of their bottling lines to produce hand sanitizer (Rowland, 2020). By repurposing an existing bottling line as well as excess distilled alcohol, it was a relatively low cost for them to make this adjustment. Their success in hand sanitizer production can also be attributed to Gallo's size and financial stability before this pandemic. It takes a financially stable company to meet a rise in demand for its current product, as well as shifting operations to produce a new product. Over 700 smaller distilleries across America, such as Smooth Ambler Distillery, a small distillery in West Virginia, also shifted their supply chain to help meet the hand sanitizer demand (Distilled Spirits Council, 2020). Like Gallo, these distilleries have successfully transitioned their supply chain as they received an increase in revenue due to increased demand in alcohol and can repurpose equipment and inventory. The alcohol industry also widely benefited from receiving support from the government, which determined the alcohol industry as an essential business during the pandemic. Government officials in the Office of Trade and Manufacturing Policy, a department in the government that is designed to serve and protect American manufacturers, also assisted in the legal aspects of sanitizer production for distilleries (Minnick, 2020).

Alcohol companies have played a vital role during both recent and historical disasters. During World War I and World War II, many distilleries repurposed their distilled alcohol to produce critical resources such as sanitizers, synthetic rubber, and antifreeze to aid the U.S. Army in war (Veach, 2018). During this period, the alcohol industry was vastly different from the current day. The Prohibition had just been created, and distilleries were no longer allowed to produce alcohol for recreation drinking. Regardless of these changes, distilleries would not have had a smooth transition from producing alcoholic beverages to these key resources, if not for the equipment and resources they already possessed. As it is easy for distilleries and Gallo to repurpose their distilled alcohol and machinery to produce sanitizing products now, it was a similar transition for distilleries during the World Wars. Distillers back then received more help from the U.S. government, as the products produced by distilleries were considered essential for the war efforts.

For alcohol companies to successfully transition their supply chain to respond to pandemics and disasters, they must utilize the resources and supplies that they already have. It is also essential for distilleries to partner with the government to ensure they can legally and safely produce sanitizers. Alcohol companies who are successful in their transition can largely contribute their success to their financial stability going into this pandemic, as well as the increase in demand for their current products. Similar to Gallo and Smooth Ambler Distillery, well-established companies in the technological and medical device industry have successfully transitioned their supply chain to help during the pandemic by utilizing and repurposing their equipment and inventory.

2.3 Technology Industry

The COVID-19 pandemic has spread across the world, and the technology industry has seen the effects on its supply chain. The U.S. technology industry has been very dependent on China as a supplier; China makes up 28% of the world's manufacturing output (Richter, 2020). In general, the technology industry stock prices experienced downward trends. During late February, Apple's stock price decreased by 2% compared to the start of the year (Ghaffary and Molla, 2020). Despite this, many of these companies are taking initiatives to help communities fight the virus. Most technology companies have done this by making monetary donations to help communities affected by COVID-19. Still, there are a few companies that have decided to help by repurposing inventory to produce items helpful in fighting the virus.

Apple is a leading company in the technology industry. They design and sell electronics such as laptops and smartphones. Apple manufactures most of its products through Foxconn, a contract electronics maker. Due to the outbreak, Foxconn shut down all its Chinese facilities early in the year and achieved 50% capacity at the beginning of March and full capacity by the end (Bursztynsky, 2020). Nonetheless, Apple began repurposing its production line to manufacture critical personal protective equipment. Starting in April 2020, the company announced its start to the production of foldable face shields for medical workers. The face shields are compact and can be assembled in less than 2 minutes. They are easy to manufacture due to its simple design, made of transparent plastic with an adjustable band (Tung, 2020). They produced around one million face shields per week and sourced approximately 20 million face masks via its supply chain. At least half of the face masks were donated to health care workers (Tung, 2020). Apple was able to make such large donations and contributions because of its financial stability and resource accessibility.

The COVID-19 pandemic is not the first disaster that these technology companies have responded to. In 2014, West Africa was hit with the deadly virus named Ebola. The reaction of the technology industry was different from today's situation. Unlike COVID19, Ebola stayed concentrated in West Africa, so technology industry supply chains were not being directly affected. Dell is an American computer technology company that predominantly manufactures laptops. In 2014, Dell was one of the few technology companies that reacted to the Ebola outbreak. They organized and donated over 100 notebooks to the CDC in only two weeks (Pevehouse, 2015). Donations are a common theme for financially stable companies during unpredictable disasters like COVID-19 and Ebola. Unlike Apple, Dell's reaction was to produce a product that they were already making and had already had the production process established.

When it came to repurposing material to produce critical equipment during a shortage, only a few companies participated. The companies able to manufacture goods to help the medical industry were financial stability and had resources available. The technology industry bears a considerable resemblance to the medical device industry and therefore had similar reactions to the COVID19 global outbreak.

2.4 Medical Device Industry

Medical device companies are integral during a public health disaster. Boston Scientific, a medical device manufacturer, used its resources to manufacture needed materials. They typically manufacture a wide range of medical devices, such as pacemakers and defibrillators. Boston Scientific expected its first-quarter revenue growth to be flat or possibly even slightly upward. During the pandemic, Boston Scientific started to produce face shields. This was executed using three of their U.S. manufacturing sites as well as collaborations with GetUsPPE.org and Prent Corporation, a nonprofit and a plastics packaging company, respectively. Around a million face shields were manufactured and donated (Kelly and Lisa, 2020). A donation of this size is possible because Boston Scientific is well established and has high revenue and lots of resources. Another critical factor in the repurposing trend is connections. In addition to face shields, Boston Scientific worked with the University of Minnesota Bakken Medical Device Center and other industry collaborators to bring to market a resuscitator titled "Coventor." The resuscitator could be used as an alternative to ventilators in emergencies. Boston Scientific also expanded its supply chain capacity to produce components for traditional ventilators. Relative to other industries, it was easier for the medical device industry to make ventilators due to the common materials in its inventory. Another sector that was able to repurpose similarly was the automotive industry.

2.5 Automotive Industry

As the pandemic disrupted business as usual, the automotive industry is yet another industry hit hard. There are approximately eight million people worldwide who work for vehicle manufacturers, and the auto industry was "bracing for a brutal year even before the coronavirus idled factories, closed dealerships and sent sales into a free fall" (Ewing, 2020). According to the Bureau of Labor Statistics, vehicle makers and their suppliers employ about 1 million people in the U.S., and a significant amount of these people are factory workers who, due to stay-at-home orders, are unable to work remotely. Furthermore, some of the most affected regions are major production hubs and critical links in the sector's global supply chain, in particular China, Japan, and South Korea (PricewaterhouseCoopers, 2020). As hospitals became overwhelmed with COVID-19 patients, automakers began to manufacture items to combat the virus. The manufacturers were not able to use their production line for cars, so they essentially repurposed their plants, and car companies around the globe were quick to supply crucial medical devices to hospitals.

Big automakers such as Ford Motor Company, General Motors (GM), Mercedes-Benz, and Tesla Inc. repurposed their facilities and materials to make medical equipment. GM geared up to help Ventec Life Systems, a Washington-based ventilator manufacturer, mass-produce ventilators that are designed to be easy to use, with touchscreen capabilities. It is a sophisticated device that requires supervision with trained clinicians and respiratory therapists. Additionally, Ford has teamed up with General Electric's health care division to help increase Airon's ventilators. These ventilators are simple in that they do not require electricity to operate, and although more advanced ventilators are in demand, this design could be crucial in field hospitals. Under the Defense Production Act, a contract was written up that included \$336 million for General Electric in partnership with Ford to produce 50,000 ventilators that would go directly into the national stockpile (O'Kane, 2020). Federal backing and protection are what enabled this industry to produce ventilators. The top enabling factors are that automakers have "a deep supply chain, work with similar materials, and have already stopped building cars" (O'Kane, 2020). This makes auto manufacturers ideal for making medical equipment like ventilators.

Tesla Inc., a leading electric car company, took to engineering new ventilator designs. Christ Vanderstock, a nurse with over 20 years of experience in anesthetics and intensive care units, reviewed these ventilators in a video and noted that two-thirds of the materials used to make the ventilators were already existing parts for Tesla vehicles (About, 2020). This reinforces the fact that because these car manufacturers are using similar materials, or can quickly get a hold of similar materials, they are fit to quickly repurpose and make medical devices in response to the shortage of medical equipment.

Yet another auto company responding to the crisis is Mercedes-AMG High-Performance Powertrains division, partnered with University College London engineers and healthcare workers at University College London Hospital (UCLH). They developed a Continuous Positive Airway Pressure (CPAP) device in less than a week. A CPAP device differs from a ventilator in that ventilators breathe for the patient, while CPAP machines do not require a tube to be inserted down a patient's windpipe, but instead applies continuous air pressure through a face mask. They are less invasive and do not require the patient to be sedated. UCLH said in a statement, "[CPAP] can help keep COVID-19 patients out of intensive care." (Maddireddy, 2020). This is a prime example of how the auto industry's broad reach into multiple sectors and ease of partnership with other companies aided in the almost seamless transition to manufacturing products for the current crisis at hand. The collaboration of the Mercedes racing division, the university, and the hospital made this possible.

COVID-19 is a unique event and has affected the automotive manufacturing industry in a way that draws little resemblance to any event in history. However, looking back on how this sector responded to past disasters can help to gain insight from those crises. In 2008, the U.S. was hit with the worst financial crisis since the Great Depression, and the automotive industry was desperate. While there were many factors at play that allowed top car manufacturers to get back on their feet, more than anything, it was government intervention that made the difference. GM received a federal bailout of \$5 billion from the Bush administration and \$17.2 from the Obama administration. Chrysler shut down production in December 2008 and received a \$4 billion federal loan (Pascus, 2020). The comparison here is that the government's help was integral in this disaster and COVID-19. Granted, the money the government gave to the former was to pull those companies out of debt and the recession. In contrast, the latter was meant to afford the necessary equipment to build life-saving devices, which the government would own in the national stockpile. Automakers were quick to respond to the crisis; they had the means, the materials, and reach to multiple sectors. They also had an urgent plea from the federal government to start production on medical equipment, much like during war times when auto production ceased car production to build weapons, aircraft, tanks, etc. (Bomey, 2020). Similar to the auto industry, another sector that had the means to respond quickly and effectively to this crisis is the retail industry.

2.6 Retail Industry

The retail industry is one that many view as non-essential; however, it makes up around 6% (Duffin, 2020) of the U.S. gross domestic product (GDP) and employs 12% of the working population (Retail Employment and Job Statistics, 2020). Thus, it is an industry that plays an essential role in the U.S. economy. The retail industry often handles an international supply chain and always needs to be responsive to customer demand to stay competitive. COVID-19 forced stores to temporarily close across the world and international supply chains to pause or stop, causing the retail industry sales to drop 6.2%. Clothing stores specifically, took the biggest hit, with sales down 50.5% (Stych, 2020).

With clothing stores temporarily closed and people reluctant to shop, fashion retail companies such as Inditex and LVMH experienced significant financial setbacks due to COVID-19, yet still managed to play their part to fight the virus. Inditex is a Spanish fashion retail company with eight brands, their most popular one being Zara (INDITEX, 2020). Due to COVID-19, Inditex closed over 3,500 stores globally. However, their online store was still running. As of April 2020, the company accounted for around a \$312M hit from the outbreak (Sheinberg, 2020). However, the company was still committed to helping combat the pandemic. Inditex created and donated surgical face masks for healthcare workers and patients in Spain (Bobb, 2020). LVMH was another large company that had been negatively impacted by COVID-19 but was still determined to make a positive impact. LVMH, Moët Hennessy Louis Vuitton, is a French company and the world leader in high-quality products, with brands such as Louis Vuitton and Dior (Lombardi, 2020). LVMH temporarily closed most of their stores. However, they still had their online stores available. In two days, LVMH took a \$13B hit (Lombardi, 2020). However, the company did not let that stop them from helping during the crisis. LVMH converted three of its perfume manufacturing sites to make hand sanitizer that was given to the French authorities and the largest hospital system in Europe (U.S. Chamber of Commerce Foundation, 2020).

Additionally, Louis Vuitton had over 300 leather good artisans create certified non-surgical face masks at 12 of their French workshops (LVMH, 2020). There were a few common key factors that enabled both Inditex and LVMH to repurpose their supplies and facilities during the time of crisis. Both companies were in financial situations where, even after taking such large financial hits, they were able to repurpose and donate products for free. Without financial backing, neither company would have been able to keep their facilities running and employees working. Additionally, both companies already had large warehouses throughout the world. Already having space and machines needed to create clothing items gave these companies a leg up when beginning to make items such as face masks and hospital gowns.

While the COVID-19 pandemic was unlike anything most people had seen in their lifetime, for the fashion retail industry, past crises such as the Great Recession of 2008 could be used for comparison. The Great Recession caused the U.S. real GDP to fall 4.3%, the unemployment rate to peak to 10%, and retail sales to drop to 35-year lows. Retail companies responded to the crisis by highly discounting items, permanently closing some stores, and slowly building an e-commerce presence (Andres, 2018). Looking at the 2008 recession could give some indication as to how the fashion retail industry might change due to COVID-19. A greater emphasis on online shopping and the shutdown of a majority of physical stores could be the future of the retail sector, to minimize human contact.

Since the fashion retail industry is not an essential industry, it was no surprise that during the pandemic, this sector took a massive hit. However, even with that, numerous companies were using their financial stability, large physical presence throughout the world, and worldly connections to repurpose their products to make positive impacts in communities.

3. Conclusion

The COVID-19 pandemic made a tremendous impact on the U.S. economy. Many industries had to adapt their supply chain to conditions that were continuously changing. Some companies chose to repurpose their production lines to produce new products to assist people through the pandemic. Companies that were successful with adjusting production had certain common factors regardless of industry. The most common enabling factor for these companies was the ability to repurpose inventory and facilities as this allowed companies to transition to producing a new product smoothly. Companies able to adjust production were often enormous, well established, and financially secure. This allowed them to remain financially stable through transitions that may otherwise lead to a critical decrease in revenue.

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