

Meat Shortage in the United States: A Review of the Effects of COVID-19 on the Meat Industry

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Abstract

COVID-19 has put a strain on the nation's ability to readily provide consumer goods at a time desperately needed. Specifically, the meat industry took a toll early on and resulted in widescale shortages and price gouging while nationwide outbreaks compelled numerous plants to shut down. Because most of the meat industry's market is controlled by only a few plants, these shutdowns drastically impacted the supply chain as well as the industry in its entirety. The scope of this paper is to evaluate the practicality of the meat industry's supply chain prior to COVID-19, analyze the upstream and downstream effects of COVID-19 in the industry, and conduct extensive research on preventative measures for future occurrences. We plan on creating cause-and-effect diagrams and root cause analyses to understand the systemic problems encountered within the meat industry. From there, our research will help determine feasible preventative measures that can be implemented in plants nationwide and will include potential logistical issues involved in implementing such measures.

Keywords

Supply Chain, Meat Industry, COVID-19

1. Introduction

1.1. Background

In April 2020, evidence of a meat shortage began to loom over the United States as meat processing plants began to close due to COVID-19. Both the chairman of the Tyson board, John Tyson, and industry experts alluded that "if the larger processing plants continue to shut down or operate with limited capacity, certain products may be unavailable and others could get really expensive," [11]. By early May 2020, "nearly 4,200 meatpackers at 115 processing plants in the United States [were] infected with the coronavirus," [12]. Beef production decreased by 25% while pork production decreased by 15% compared to a year ago [12]. As local markets started to feel the strain of limited availability, store policies began to restrict customer purchases. Ackles, a Wellesley-based company, mentioned "we're starting to limit products to two packages of each type right now, at least for the foreseeable future," [12] while larger companies such as Walmart, Kroger, Publix, Giant, and Safeway followed suit [13]. Through mid-May, "more than 30 plants [had] shut," [13] which prompted concerns within the entire supply chain, from the local farmer up to the consumers.

To address these concerns and keep the meat industry afloat, the President of the United States signed an executive order allowing processing facilities to remain open during the pandemic after being lobbied by the big meatpacking companies [14]. Under this order, the USDA would work with the processing plants to ensure they operate in accordance with CDC and OSHA guidelines, as well as state and local officials to affirm these plants can operate and produce meat products to meet demand [14]. At the height of the pandemic, big meat processing plants like Tyson Foods, Smithfield Foods, JBS and Perdue Farms were all affected due to plant closings and all have stated that they will be affected for months to come [14].

1.2. Objective

This report examines the cause of the meat industry's supply chain to break under such pressure and will investigate alternatives measures that the industry can take to avoid a similar event.

2. A Historical Look at the Current System

Several components comprise the meat industry, which include the raising of livestock, slaughterhouses, processing, packaging, and distribution. "These days, the top meatpacking companies do not just produce meat, they also control how the animals are raised longer before slaughter," [1].

Presently, the nation's meatpacking and slaughter industry is controlled by four large corporations: Tyson Foods, JBS, Cargill, and Smithfield Foods [4]. "As of 2015, the four largest companies in each sector-controlled 85 percent of the beef packing industry, 66 percent of pork packing, and 51 percent of broiler chicken processing" [1]. This is possible through the vertical integration supply chain approach that has been adopted by the industry, where slaughter, processing, packaging, and distribution are highly monopolized and consolidated. These corporations own all parts within the supply chain, which allows them to control both price and quality of meat products across the nation while simultaneously making large amounts of profit.

Because only a handful of plants control the industry, the closure of one has a snowball effect and can be detrimental to the entire supply chain while smaller more rural plants cannot offset this impact alone [2]. As a Kansas rancher reported, "the whole system has proven to be a total failure," [3]. However, the system did not evolve by accident.

There has been a decades-long deregulatory pattern in the meatpacking industry, stemming back to the dawn of the industrial meat era. In 1905, meatpacking companies Swift and Armour were keen to increase the production chain and pressed meat cutters to work faster [16]. Motivated by increase demand, "the speeding-up seemed to be growing more savage all the time," [16]. A year later in 1906, the Pure Food and Drug Act as well as the Federal Meat Inspection Act were enacted to protect consumers but did little to reform labor practices in the packinghouses [16]. As the big meat packers began to take a monopolistic control of the industry, a national investigation under President Woodrow Wilson concluded that big packers were colluding against farmers and price-fixing to defraud consumers while expanding into other food sectors [16]. Thus, the Federal Trade Commission Act of 1914 was passed and outlawed unfair methods of competition. However, it did not lead to an indictment of the meat packers. Instead, the Packers and Stockyards Act was established that banned the meat packers from expanding into other food sectors [16]. In the late 60s to early 70s, under President Nixon's administration, support was given to deregulation and market concentration. The federal government "went from policing food trust at home to running an international food ring," and President Reagan followed suit in his own administration [16].

Deregulation and market concentration did not come without consequences. In 1973, "there were nearly 3,000 packinghouses operating in the United States. Twenty years later, that number plummeted to fewer than 200," [16]. During Reagan's administration, there were approximately 600,000 hog operations nationwide but that plummeted to 80,000 twenty years later [16]. The big meatpacking companies have dominated the industry and this trend has continued into the 21st century. It was reported that an estimated 71% of chicken farmers were at or below poverty line by 2001 [16]. They filed a lawsuit under the Packers and Stockyards Act but the meat and poultry industry lobbied to remove language targeting price-fixing in the report and "Congress defunded implementation of the change through an appropriations rider," [16]. To this day, this has been an ongoing pattern.

3. COVID-19 Impacts on the Supply Chain

3.1. Distancing Measures Between Workers

COVID-19 impacted the overall meat supply chain in many ways. When the virus was declared a national pandemic in March, workers stopped showing up to facilities due to fear of spreading or receiving the virus. The fragility of the supply chain was not realized until thousands of workers in meat processing facilities had fallen ill from COVID-19. While we commonly know of the CDC defined "6-feet" in place, the elbow-to-elbow environment of processing lines in manufacturing facilities created an environment that made the virus easy to spread. "At least 54,036 workers (39,905 meat packaging workers, 8,343 food-processing workers, and 5,788 farmers) have been identified as COVID-19 positive and at least 232 workers (184 meat packaging workers, 34 food-processing workers, and 14 farm workers) have lost their lives" [33]. Facilities were forced to not only balance uncertain demand and breaking supply chain, but to find a way to keep their facilities in production.

Within meat manufacturing facilities, employees often work in close proximity to each other, making it more difficult to respect the physical distancing requirements given by the CDC. Furthermore, the living conditions workers are in poses a difficulty as many live in overcrowded conditions with each other. According to the organization for Economic Cooperation and Development (EOCD), in some cases, “Meat processing appears to be more sensitive than other types of food processing in part because of the labor intensive nature of operations” [34]. In comparing with other products, such as grain handling and processing, their supply chain process is highly automatized and requires less hands-on experience from physical workers. Within this supply chain, a pandemic has less of an impact as there is less worry about a lack of workers to keep up with demand. Within the meat production front, however, the process still involves many workers on the factory floor and poses a greater threat to the supply chain.

Since March, many meat processing plants have shut down or at the very least, been forced to operate at reduced capacity. The change in demand from the meat facilities trickled down and greatly affected the farmers who provision the resources. In the United States, “cattle and pig slaughter fell by about 40% in April compared to the same period in 2019” [34]. Looking at the supply chain, the farmers themselves were most significantly affected as they stored all the “raw material” and were the middleman for the large meat corporations. When demand dropped at the height of the pandemic, they were forced to hold large amounts of inventory as manufacturing operations slowed down. The severity of the pandemic was not focused on, with stakeholders encompassing a great value on income and financial pressures.

3.2 Effects of the Pandemic on Consumer Behavior

With the pandemic changing several aspects of our lives, there were several key contributors to the change in consumer behavior. The closure of restaurants and public dining establishments led to an unusual spike in retail shopping compared to food service. The number of visits to food stores decreased, however the money consumers spent on food was raised per visit [33]. Looking at this statistic, it is clear that the visits to food stores decreased directly because of the pandemic, and consumers began to stock on food in greater quantities due to an uncertainty of what was going to happen within the next few days. “Interestingly, bread and baked products kept their place on the supermarket shelves. Consumers have focused on the products with long shelf life such as dried or canned foods, pasta, milk, or milk substitutes, and frozen foods due to convenience and daily cooking at home (USDA).” People began to stock on long-lasting foods for their homes and focus on home baking from fear, rumors and false information causing people to change their traditional behavior. Typical consumers shifted their focus from a normal way of getting groceries into one that was very clearly motivated by the pandemic.

Studies by the Food Industry Association analyzed consumer behavior throughout the pandemic and found that “75% of consumers made changes in their meat purchasing behavior with at least half buying different brands (58%), cuts (51%) or types (50%) of meat” [39]. Not only did people change their meat purchasing behavior, but additionally during the pandemic, consumers are now cooking more meals and need more variety (50%), cooking new recipes (37%) and experimenting with different cuts/kinds of meat (34%) [39]. The change in consumer behavior is an adaptation of consumers lives changing, keeping them indoors and less inclined to go to external restaurants to eat.

3.3 Consumer Behavior Affecting Pricing

The unprecedented shocks in supply and demand affecting the supply chain translated directly to pricing. According to the U.S Census Bureau, demand for food at grocery stores has declined from the record levels we saw in March but remains 13 percent higher than same period last year [35]. This report studying retail and food services is tied to the uncertainty that led people to purchase large, unnecessary amounts of meat, while also showing how grocery shopping overall increased significantly compared to the same time one year before the pandemic. Furthermore, a less efficient supply chain overall led to the increases in prices, significantly within the meat industry.

In terms of price changes, the typical consumer saw an increase in retail food prices in the month of April, with the highest prices led by meats and eggs. According to data from the Bureau of Labor statistics (BLS), “the food price index increased 1.5 percent in April, following a 0.3-percent increase in March. The index for meats, poultry, and fish rose sharply by 4.3 percent... its largest monthly increase ever recorded by BLS. The food at home Consumer Price Index increased 3 percent from March to April and 0.5 percent from February to March, based on data from yesterday” [36]. The small increase of 0.3% in March can be attributed to the lockdown that completely shocked consumers who were forced to stay home. In April, consumer behavior had already significantly changed, and people began to buy large amount of unnecessary good in preparation. Furthermore, the pandemic began to accelerate in the United States

with outbreaks in meat processing facilities leading to a domestic meat shortage, forcing an increase in demand for imports. The United States became more dependent on imports as our own supply chain was significantly affected. “In turn, import meat prices rose 16.0 percent in May 2020, the largest 1-month jump since the index was first published monthly in December 1993.” [36]

3.4 Retail Demand Supply Chain with Farmers

The COVID-19 pandemic showed the short comings in our supply chain, and the fact that it was so consolidated led to it breaking under pressure. As a result, it led to food loss and significantly affected those are the bottom of the supply chain, farmworkers and farmers. Looking at the supply chain before COVID-19, meat production was a finely tuned, down to a science supply chain following just-in-time principles. In doing so, an efficient supply chain working between farmers and manufacturers was feasible and cost effective. However, the fluctuation changes in demand are leaving farmers with nowhere to sell their pigs and cows ready for market. Due to space limitation and costs, farmers have been forced to get to the point of euthanizing animals. In an article discussed by the University of Illinois, they relay that “Officials estimate that about 700,000 pigs across the nation can’t be processed each week and must be euthanized. Most of the hogs are being killed at farms, but up to 13,000 a day also may be euthanized at the JBS pork plant in Worthington, Minnesota” [37]. Change in consumer behavior with the pandemic significantly affected manufacturing facilities and farmers and can be tied directly to the pandemic and change in consumer behavior. Predicting demand also poses a difficulty as there is uncertainty about when demand will ramp up again and require more.

3.5 Global Food Trade and Transportation

COVID-19 caused a significant impact on food trade and led to disruption in food supply chain due to the export restrictions. “Export-restricted policies pushed up world prices of stable food commodities such as wheat, maize, and rice and resulted in reduction of the quantity and quality of food eaten [38]”. As mentioned in Section 3.4, the just-in-time aspect of manufacturing was crucial to the uninterrupted aspect to transportation that provided fresh meat critical to the supply chain. The shortage of workers in meat facilities due to COVID isn’t the only potential disruption to the supply chain; a shortage of truck drivers would prevent products from leaving the farm and provides a concern from animal welfare and food safety in live animal transport.

At an international level, the supply chain is also significant and can be disrupted. “If planes are grounded, fresh produce can’t be exported overseas. This means that farmers and exporters can’t access high-value overseas markets, affecting international trade” [31]. Figure 1 below shows the dramatic increase between meat within imports Another area affecting the supply chain was sourcing refrigerated shipping containers from China that also became an issue during COVID-19 shutdowns. A fragile supply chain within the United States leads to a greater dependency on a global supply chain. However, a global pandemic also poses a threat to the global supply chain creating a large feeling of uncertainty overall.

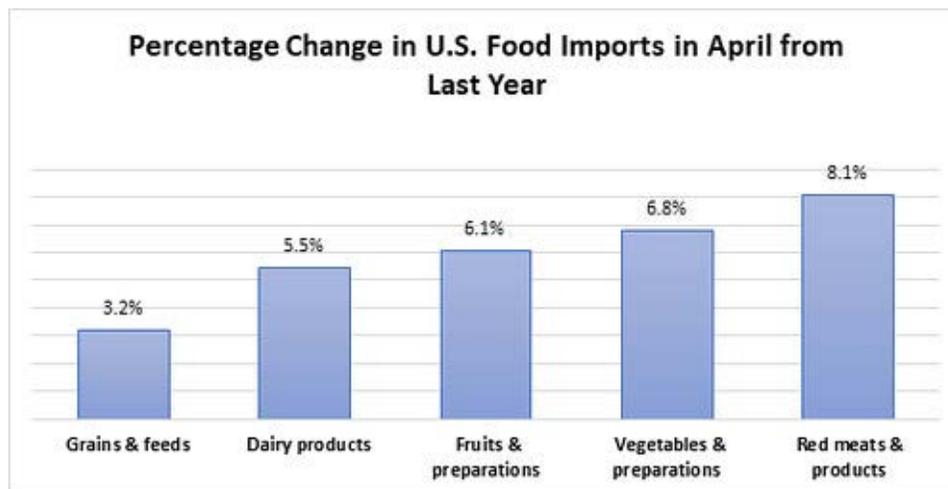


Figure 1: Food Imports % Change

3.6 Excess Food Waste

COVID-19 outbreaks forced many processing plants across the country to shut down. Poultry and pork production in America tend to operate on a just in time schedule. This means that as old animals are shipped out, new animals arrive. The American meat system funnels as many animals from the farm to the processing plant as quick as possible. This system allows American meat products to be priced cheaper than most countries [2]. The shutdown of major processing plants caused a disruption in the supply chain and left farms with an excess of animals. Due to this, farmers were left with difficult decisions about whether to allow the excess animals in the barn risking overcrowding or to euthanize the excess animals [25]. Many farmers chose to euthanize their excess production. One plant JBS even reopened solely to euthanize animals, not to process meat [25]. This bottleneck caused meat prices to skyrocket and a shortage of meat for the American consumer. The price increase primarily arose from a decrease in the supply of meat. The USDA estimates beef production for April 2020 to be 20% lower than April 2019, and pork production to have fallen 10% from the previous year [26]

3.7 Glimpse into the Future of the Meat Supply Chain

Meat suppliers are currently looking into their future and what adaptations they plan to make to help prevent supply chain disruptions from future pandemics. Tyson Foods gathered a panel of medical professionals, epidemiologists, and food safety experts to advise Tyson on future thinking and further action regarding COVID-19 [32]. These experts have advised Tyson Foods to have an ongoing vigilance for public health and safety especially in regard to their employees, to continue testing their employees through 2021, and to keep engagement with public officials [32]. Tyson Foods expects many of these changes to be permanent changes to help encourage a healthy and safe working space for their employees. Tyson plans to publish a paper documenting key discussion points and advice from the panel in order to help other food suppliers maintain safe and healthy workspaces [32]. The COVID-19 pandemic will long term change the meat industry with a greater focus on public health and illness prevention.

4. Alternatives

Introducing Medium-Small Meat Processing Plants

As mentioned in section 2.1 much of the meat industry heavily relies on big processing plants at which processes meat incoming from a small to big size farms. These farm stock up livestock based on demand from these corporations and during the pandemic many had to reduce production capacity which lead to meat shortages throughout the country. By allowing more medium-small meat processing plants this will allow farmers to control all operations from end-to-end. According to Tyrone Gustafson a small Iowa slaughterhouse and butchering facility owner stated that “The pandemic changed everything,” Gustafson said. “We had a lot of farmers that would take a majority of their livestock to the commercial processors, the big guys, but they had so many friends, neighbors, and family members contact them wanting to buy directly from them. We’re working overtime to try and keep up with the demand that exists from people buying direct, buying in bulk, just wanting to know where their food comes from” [10]. The disruption with the big commercial processors due to pandemic allowed the smaller scale processors to pick up the existing demands and new direct to consumer orders which increased significantly. Large meat packing plants experienced outbreaks in their facilities because of working conditions such as workers packed in small spaces. The challenge that prevented small meat processors to be open successfully was “federal laws requiring large animals to be processed at a slaughterhouse under the supervision of a USDA inspector have left many small meat producers in a bind” [10]. Now congress is changing this federal law and many states are responding by launching supplementary programs to expand local meat processing.

Vertical Integration

Vertical integration is a supply chain strategy that ties “together or more functions of production, marketing or processing of an industry under one entity,” [5]. This allows the meat company to take over multiple phases of production and distribution which creates efficiencies and reduces cost. Two of the most commonly used vertical integration strategies are backward integration and forward integration [7]. Backward integration is a process where a company expands or acquires other companies that will supply raw material for production of product. Forward integration is when a company expands by purchasing and controlling the direct distribution or supply of its products [7]. Meat sectors such as poultry and pork have been more successful than beef in implementing vertical integration into their industry structure because of the vast differences in operations. “Poultry and pork operations have grown larger in recent decades to take advantage of lower costs that come with economies of scale. However, the beef business continues to have legions of small operators --- some with fewer than 30 head of cattle --- because the animals require large plots of land for foraging. It's harder to consolidate and manage smaller, more diverse cattle farms and

growing operations, so vertical integration isn't practical among beef producers" [22]. This is how industry has been operating until the pandemic hit earlier this year in which meat sectors are recognizing a need for change of structure.

Vertical integration has been successful for the poultry and pork sectors and during the pandemic had experienced a similar spike in price to beef, but at a lower magnitude. By implementing vertical integration small cattle ranchers can consolidate production, transportation, slaughterhouse, and meatpacking. Producing feed on the same pastures that maintains the cattle would help reduce cost and ensures food supply stability. Ranchers can also buy trailers to transport cattle to the slaughterhouse or the market and this gives the rancher full control to ensure goods get delivered. "Being able to slaughter, pack and then wholesale the product would offer the most significant cost savings of the whole vertical integration model" [23]. For ranchers to construct and maintain a slaughterhouse and meatpacking is very difficult and cost of operations are very high. It would take a lot of coordination with officials to follow all regulations which include safety and health issues to run an efficiently facility but, in the end, it would pay off greatly.

Radio Frequency Identification (RFID)

With the current contactless culture that workplaces are experiencing, the implementation of RFID is becoming more prevalent as it provides a robust solution to inventory control with less human interaction. Radio frequency identification or RFID's purpose is to transmit the identity of an object through radio frequency waves. Fundamentally the system is comprised of two parts, the reader and the tag which acts as the receiver and emitter respectively. By utilizing this technology, the amount of human contact can be reduced which can help fight the spread of COVID-19. This can be taken a step further by implementing drones with embedded RFID readers. Applications include keeping track of inventory, visualizing the flow of meat within the process, taking measurements of the temperature of meat, or keeping track of what employees have come within six feet of each other [21]. Beyond reducing the amount of human contact present, there are other financial incentives to invest into RFID.

RFID is both more accurate and efficient as it does not rely on multiple manual processes that include capture, transcription and computer entry which introduces many chances for human error to exist. According to Avery Dennison, these improvements in efficiency normally yields a reduction in labor costs that has been high as 50% in the food supply chain [20]. These cost reductions are increasing with every passing year as equipment and labeling costs are dropping due to advancements in technology. Being able to enter data in real time also reduces lag between data collection and entry which could lead to the meat expiring sooner [9]. This has compounding effects when transporting meat in a global market, as regulatory systems in the origin country often differ from the consumption country. This creates more opportunities for foodborne illness to enter the supply chain. This has profound effects on not only the quality of the goods but the perceived quality by the consumer. For example, in the 2007 Food Marketing Institute's US Grocery Shopper Trends, a study was done to gauge consumer confidence in food safety and documented a 22% decline in "complete/somewhat confident" -- 88% to 66% -- which was the lowest point since 1989," [8].

Plant Based Meat Alternatives

Unlike standard consumer goods like meat, the plant-based industry has had little negative impact due to the pandemic. Inadvertently, it has benefitted in a sizeable scale with a market growth projection to be more than 17% due to the impact of COVID-19 alone [17]. "By removing animals from the production equation, plant-based meat companies are not beholden to the system shocks affecting the animal-based meat supply chain," [18].

Prior to coronavirus, the plant-based market was restrictive and had strict regulations governed by the FDA. However, the FDA relaxed its guidelines for selling plant-based meat products in the market to address the apparent issue of meat shortages in the United States. Due to this demand shift, key plant-based companies like Beyond Meat, Impossible Foods Inc, and Tofurky Co are investing heavily in the retail sector and have increased their production, expanded stores, and offered discounts on their products [17].

Since then, the plant-based meat market has remained resilient and has adapted quickly to meet unprecedented shifts in demand. "Plant-based meat dollar sales growth has not only outperformed its prior year performance, but it has also outperformed animal-based meat's dollar sales growth over the same time period through April and May of this year," [18]. Furthermore, "Beyond Meat increased its market by 49% due to meat supply shocks as a result of the Covid-19 crisis," and it is also "likely to benefit from the massive shift of consumers to meat alternatives, post the COVID-19 pandemic," [17]. Other plant-based companies are likely to follow the same success as Beyond Meat as more

consumers continue to shift their perceptions post-pandemic. A consumer survey found that approximately 60% of respondents are more inclined to participate in healthier eating practices post-pandemic [17]. This gives meat-alternative companies an advantage with the new shift in consumer behavior and it is possible to “expect shifting perceptions around food safety and sustainability will only cause an increased interest in plant-based options for the future,” [17].

The European Union’s Meatpacking Industry

The European Union’s meatpacking industry employs approximately two-thirds the number of U.S. workers, 350,000 people [19]. “Yet European meatpackers have had only a fraction of the coronavirus cases that have swept the U.S. plants and far fewer deaths,” [19]. The United States had 24,715 COVID-19 cases and at least 86 dead in the month of June. Comparatively, slaughterhouses in the European Union had 2,670 cases and at least 4 dead within the same month [19]. Both American and European meat industries operate and perform similarly. Employees are kept in close quarters, hindering social distancing efforts, and their respective industries are highly consolidated [19]. The discrepancy between the number of cases in Europe and the United States can be derived from three key factors.

One factor is size. Europe’s slaughterhouses are smaller on average when compared to those in the United States. “The region does have a small handful of very large slaughterhouses, but even those are still not as big as their supersized American counterparts,” [19]. This directly impacts the spread of the virus. In a smaller facility in Europe, infections are capped and are generally limited but because America’s facilities are much larger, this can facilitate and increase transmission rates.

Scalability is also an important factor. “With slaughter operations spread across smaller plants, German meat companies have been able to close individual facilities with coronavirus cases and shift production to other locations,” [19]. Operating at this scale makes European slaughterhouses more resilient to economic shocks due to COVID, unlike American ones, and there have been no signs of any meat shortages.

Line speed, likewise, is a substantial factor. American meatpacking workers work faster than European ones as line speeds are set by the federal government. This contributes to conditions that interfere with coronavirus precautions since “you can’t even stop to cough into your hand or your elbow because the line speeds are so, so fast” [19]. On the contrary, Europe does not have government-wide speed limits and overall “slaughter lines in much of Europe are slower,” [19]. These conditions make it easier to abide to COVID-19 protocols and contribute to a safer environment. “While no single factor explains this discrepancy, union officials, academics and market analysts all say that differences in baseline worker protections, the ways the industry is structured, and the political response to the virus are likely at play,” [19].

5. Conclusion

COVID-19 exposed longstanding food system issues that are often ignored in the meat industry. The current problem facing the industry is not the availability of meat supply. As a matter of fact, at the beginning of the pandemic there was a backlog of pigs as more plants began to shut down leaving animals stranded at farms for an extended period of time. “The problem is getting the meat from the farm to the table and the processing plants are the weak link in this chain,” [27]. Before the industry had become highly consolidated, this was not a problem. Not only did the U.S. have small and medium-sized processing plants across the nation but “most communities had at least one slaughtering facility/butcher shop where a small number of animals could be slaughtered and processed,” [27]. With consolidation came a lack of resiliency. As processing plants began to close, the supply chain began to be disrupted. On the contrary, small livestock farms and processors that exist outside the consolidated corporate system showed resilience during the pandemic as they were not reliant on the broader meat industry infrastructure. This direct-to-consumer-business structure as well as turning to automation like RFID and looking at other meat alternatives and the European meat industry response can all be used to strengthen the supply chain.

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