

Empowering Food and Agriculture to Respond as Critical Infrastructures to COVID-19 and Future Pandemics

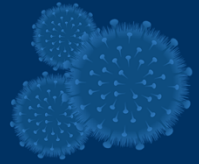
Part 1: An Epidemic Becomes a Pandemic



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This publication is part of a partnership between Auburn University's McCrary Institute and Air University pursuant to which challenges related to cyber and critical infrastructure security are examined for the purpose of advancing U.S. national security.

ABOUT US



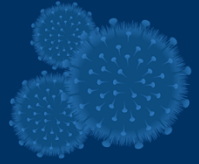
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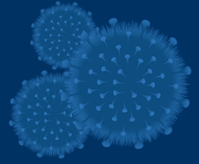
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PART ONE



Beyond providing the animal protein and plant products we consume, food and agriculture make important contributions to the nation's economy. The United States Department of Agriculture indicates that "Agriculture, food, and related industries contributed \$1.053 trillion to U.S. gross domestic product (GDP) in 2017, a 5.4-percent share. The output of America's farms contributed \$132.8 billion of this sum—about 1 percent of GDP."¹ Additionally, Agriculture and its related industries provide 11 percent of U.S. employment, which in 2018 represented 22.0 million full- and part-time jobs. Food and Agriculture are Critical Infrastructure Sectors, as defined by Presidential Policy Directive 21 (PPD-21): Critical Infrastructure Security and Resilience, which is designed to advance "a national policy to strengthen and maintain secure, functioning, and resilient critical infrastructure."²

The COVID-19 pandemic has changed the world. People have died, others have become ill, and the world economy has been severely damaged, all because of a viral infection for which we were not fully prepared. For the first time, since the Depression years, Americans have faced empty grocery shelves. The reasons for this apparent shortage at the start of the pandemic was not an actual failure of the food supply, but rather a reflection of demand. The American public did not know what the future would bring and therefore bought every food and paper product thought necessary, should they too become ill or potentially not have access to, due to movement restrictions. Although, the nation previously recognized the importance of Critical Infrastructures (CIs), the social and economic effects associated with COVID-19 have refocused the need for renewed scrutiny. "Functioning critical infrastructure is imperative during the response to the COVID-19 emergency for both public health and safety as well as community well-being. Certain critical infrastructure industries have a special responsibility in these times to continue operations."³

Something changed in March and April, 2020 for U.S. agriculture and food. The food supply chain, which was always assumed to be secure, began to experience problems, as meat processing plants began to close, as workers fell ill. Shortages soon followed and the food chain, which was both labor intensive and dependent upon a functioning and continuous input/output model started to falter.

The Series

The following series of articles will explore the complexities of the COVID-19 pandemic, paying closest attention to its implications to agribusiness, but also more broadly to food and agriculture. Agriculture and food are Critical Infrastructures, vital for the welfare of the U.S., its

¹ Source: <https://www.ers.usda.gov/data-products/ag-and-food-statistics-charting-the-essentials/ag-and-food-sectors-and-the-economy/>

² Source: "Critical Infrastructure Sectors". Link: <https://www.cisa.gov/critical-infrastructure-sectors>

³ Source: <https://www.cisa.gov/identifying-critical-infrastructure-during-covid-19>

citizens and economy. The series will also explore the implications to food safety, security and food defense. Agriculture and food are also national security matters, enabling the U.S. to protect itself and project power around the world.

Part 1: An epidemic evolves and a pandemic begins.

Part 2: The pandemic takes hold in the Critical Infrastructures of Food and Agriculture.

Part 3: Strategic implications/critical infrastructure vulnerabilities.

Part 4: Planning for future pandemics.

The Clinical Picture to Date

Those infected with the SARS-CoV-2 virus (responsible for the COVID-19 pandemic generally manifest symptoms in less than 14 days, the majority of which occur in the first five days after exposure.⁴ Disease manifestations range from asymptomatic or mild infections, which may include viral shedding, to severe disease and mortality. Asymptomatic or mildly affected individuals may be responsible for some portion of community spread cases⁵.

As has been described elsewhere, certain populations appear to be at significantly higher risk to severe or fatal illnesses, including those with advanced age and comorbidities such as cardiovascular diseases, chronic lung or kidney disease, hypertension and diabetes mellitus, obesity, cigarette smoking and cancers.⁶ Early in the pandemic in China⁷, Italy and the United States, males appeared to have been at higher risk of death, as did people of color in the United States.^{8,9} This later finding may be related to a combination of factors, such as higher incidence of co-morbidity or to underlying socioeconomic status, which may disproportionately affect living conditions outside of work (e.g. multiple individuals sharing living spaces).

Food processing plants can be thought of as small communities, often located in rural settings, where the population lives and works in a relatively small geographic area. These close-knit communities often share social events (e.g. funerals), which at times have been

⁴ Source: Sethuraman N, Jeremiah SS, Ryo A. Interpreting Diagnostic Tests for SARS-CoV-2. JAMA. Published online May 06, 2020. doi:10.1001/jama.2020.8259. Link: <https://jamanetwork.com/journals/jama/fullarticle/2765837>

⁵ Furukawa, Nathan, J.T. Brooks and J. Sobel (2020). "Evidence supporting transmission of severe acute respiratory syndrome coronavirus 2 while presymptomatic or asymptomatic". Emerg Infect Dis. 2020 Jul [date cited]. <https://doi.org/10.3201/eid2607.201595>

⁶ Source: <https://www.cdc.gov/coronavirus/2019-ncov/hcp/clinical-guidance-management-patients.html>

⁷ Source: Zhang JJ, Dong X, Cao YY, et al. Clinical characteristics of 140 patients infected with SARS-CoV-2 in Wuhan, China [published online ahead of print, 2020 Feb 19]. Allergy. 2020;10.1111/all.14238. doi:10.1111/all.14238. Link: <https://pubmed.ncbi.nlm.nih.gov/32077115/>

⁸ Severe Outcomes Among Patients with Coronavirus Disease 2019 (COVID-19) — United States, February 12–March 16, 2020. MMWR Morb Mortal Wkly Rep 2020;69:343-346. Link: https://pubmed.ncbi.nlm.nih.gov/32214079/?from_single_result=32214079&expanded_search_query=32214079

⁹ Auwaerter, Paul G. (2020). "Coronavirus COVID-19 (SARS-CoV-2)" Johns Hopkins Medicine – POC-IT Guide. Link: https://www.hopkinsguides.com/hopkins/view/Johns_Hopkins_ABX_Guide/540747/all/Coronavirus_COVID_19_SARS_CoV_2_.

associated with disproportionately high numbers of COVID-19 cases.¹⁰ A recent report by the CDC indicated that "...many workers live in crowded, multigenerational settings and sometimes share transportation to and from work, contributing to increased risk for transmission of COVID-19 outside the facility itself."¹¹ Infected individuals who have close contact with others for extended periods of time (e.g. through shared housing) are likely to spread the disease to those individuals. Given the safety protocols and disinfection schedules now being implemented by agriculture and the food processing industry, it is quite possible that future infections will involve community spread (person-to-person), rather than through workplace environments.

As a respiratory illness, person-to-person spread through droplet nuclei are considered a primary mode of transmission. The impact of viral spread through the airborne route, including spread by asymptomatic viral shedders, emerged as a significant concern.¹² Research suggests that active (i.e. infective) viral particles can travel well past the 6 foot perimeter recommended by social distancing.¹³

Food Safety

COVID-19 does not appear at this time to be a food-borne disease. Food processing employee protocols are mainly being conducted to prevent the spread of the virus between workers, thereby also reducing the chance of an infected worker coming into contact with food product. There has been no known transmission of 2019-nCoV from food or food packaging; food should be considered safe, if the processor engages in good food hygiene and worker hygiene procedures, as was required before the pandemic.

The Pandemic Begins – Public Health Information Gaps

How and exactly from where the virus emerged is even now being hotly debated, since China from the start obfuscated and even implicated the U.S. as the source of the infection through their propaganda outlets. Many question whether China's obfuscation and accompanying

¹⁰ "Cases of COVID-19, the disease caused by the novel coronavirus, hit 967 in Albany...according to Johns Hopkins University researchers. It's a number dwarfed in size by New York City's more than 157,000 or New Orleans' 9,917, but on a per-capita basis the outbreak makes Albany the fourth-worst hit in the country, with 659 cases for every 100,000 people."Source: "How a small Georgia city far from New York became one of the worst coronavirus hotspots in the country", Graham Rapier (2020). Business Insider. Posted 7 April 2020. Link: <https://www.businessinsider.com/coronavirus-hotspot-albany-georgia-funderals-covid-19-cases-per-capita-2020-4>.

¹¹Source: Dyal, Jonathan W., Michael P. Grant, Kendra Broadwater, et al, 'COVID-19 Among Workers in Meat and Poultry Processing Facilities – 19 States, April 2020, Morbidity and Mortality Weekly Report, U.S. Department of Health and Human Services/Centers for Disease Control and Prevention. May 8, 2020; Vol. 69 (18): 557-561. Posted 8 May 2020. Link: <https://www.cdc.gov/mmwr/volumes/69/wr/mm6918e3.htm>.

¹² Source: Wong SC, Kwong RT, Wu TC, et al. Risk of nosocomial transmission of coronavirus disease 2019: an experience in a general ward setting in Hong Kong [published online ahead of print, 2020 Apr 4]. J Hosp Infect. 2020;S0195-6701(20)30174-2. doi:10.1016/j.jhin.2020.03.036. Link: <https://pubmed.ncbi.nlm.nih.gov/32259546>.

¹³ Source: Liu, Y., Z. Ning, M. Guo, et al. (2020). "Aerodynamic analysis of SARS-CoV-2 in two Wuhan hospitals." Nature. 2020 Apr 27. doi: 10.1038/s41586-020-2271-3. [Epub ahead of print]. Link: https://www.ncbi.nlm.nih.gov/pubmed?myncbshare=usafvlib&holding=usafvlib_ff&term=32340022&report=abstract&format=te xt

delay in admitting person-to-person spread (community infection), enabled the disease to gain a better foothold in the rest of the globe. Additionally, China seized control of personal protective equipment (PPE) being manufactured for export to the U.S. A Congressional Research Service report, dated April 6, 2020 states,

“In early February 2020, the Chinese government nationalized control of the production and dissemination of medical supplies in China. Concerned about shortages and its ability to contain the COVID-19, the Chinese government transferred authority over the production and distribution of medical supplies from the Ministry of Information Industry and Technology (MIIT) to the NDRC, China’s powerful central economic planning ministry. NDRC commandeered medical manufacturing and logistics down to the factory level and has been directing the production and distribution of all medical-related production, including U.S. companies’ production lines in China, for domestic use.”¹⁴

The report also indicates,

“China’s nationalization efforts, while understandable as part of its efforts to address an internal health crisis, may have denied the United States and other countries that depend on open and free markets for their health care supply chains access to critical medical supplies. On February 3, 2020, China’s Ministry of Commerce directed its bureaucracy, local governments and industry to secure critical technology medical supplies and medical-related raw material inputs from the global market, a situation that likely further exacerbated supply shortages in the United States and other markets. To ensure sufficient domestic supplies to counter COVID-19, China’s Ministry of Commerce also called on its regional offices in China and overseas to work with PRC industry associations to prioritize securing supplies from global sources and importing these products. The Ministry of Commerce provided a list of medical suppliers and distributors in 14 countries and regions to target in quickly assuring supply. The Ministry also prioritized food security and the need to increase meat imports. China’s trade data shows that these policies led to steep increases in China’s imports of essential PPE and medical supplies, including the raw materials needed to make products such as N95 masks. The policies also contributed to sharp decreases in China’s exports of these critical medical products to the world.”¹⁵

The United States’ Office of the Director of National Intelligence (ODNI) perhaps brought some degree of clarity to the virus origin controversy on 30 April 2020 stating categorically, “The entire Intelligence Community has been consistently providing critical support to U.S. policymakers and those responding to the COVID-19 virus, which originated in China. The

¹⁴ Congressional Research Service (2020). “COVID-19: China Medical Supply Chains and Broader Trade Issues” 6 April 2020. Report R46304. Link: <https://crsreports.congress.gov/product/pdf/R/R46304>.

¹⁵ Congressional Research Service (2020). “COVID-19: China Medical Supply Chains and Broader Trade Issues” 6 April 2020. Report R46304. Link: <https://crsreports.congress.gov/product/pdf/R/R46304>.

Intelligence Community also concurs with the wide scientific consensus that the COVID-19 virus was not manmade or genetically modified.”¹⁶

Additionally, the ODNI indicated, “The IC¹⁷ will continue to rigorously examine emerging information and intelligence to determine whether the outbreak began through contact with infected animals or if it was the result of an accident at a laboratory in Wuhan.”¹⁸

Although, U.S. intelligence agencies issued classified warnings in January and February about the global danger posed by the corona virus, the direct impacts of the pandemic, as well as the second and third order effects on US infrastructure caught many inside and outside of government by surprise. The Department of Homeland Security launched a living document called the “Master Question list”¹⁹, which “...quickly summarizes what is known, what additional information is needed, and who may be working to address” fundamental questions about COVID-19. The CDC has subsequently launched a new system to track the virus called “COVIDView”²⁰. Business decision makers suffered from the lack of vetted information and the rapid changes that occurred as CDC and other federal, state and local agencies tried to interpret the rapidly evolving information and deal with the many information gaps.

COVID-19 diagnosis was also complicated by delay, when clinics awaiting a definitive test from the Centers of Disease Control and Prevention (CDC) received contaminated reagents, causing a recall of the test kits. A subsequent investigation by the Food and Drug Administration (FDA) revealed the reagents were contaminated by, “Sloppy laboratory practices...”²¹, which included working with the SARS-CoV-2 virus in the same laboratory, used for the manufacturing of the test kit. This practice in fact was a serious violation of their own biosafety protocols²².

Simultaneous to these problems, FDA barred the import of alternative test kits and prevented laboratories and hospitals from developing their own tests, preferring no test, rather than one that was not manufactured by the CDC. The combined result? “All of this set the United

¹⁶ Source: <https://www.dni.gov/index.php/newsroom/press-releases/item/2112-intelligence-community-statement-on-origins-of-covid-19>

¹⁷ IC is the acronym used to designate the U.S. Intelligence Community.

¹⁸ Source: <https://www.dni.gov/index.php/newsroom/press-releases/item/2112-intelligence-community-statement-on-origins-of-covid-19>

¹⁹ Source: “Master Question List for COVID-19 (caused by SARS-CoV-2)”, U.S. Department of Homeland Security. 5 May 2020. Link: <https://www.dhs.gov/publication/st-master-question-list-covid-19>

²⁰ Link: <https://www.cdc.gov/coronavirus/2019-ncov/covid-data/covidview/index.html>

²¹ Source: “C.D.C. Labs Were Contaminated, Delaying Coronavirus Testing, Officials Say”. Sheila Kaplan, New York Times. 18 April 2020. Link: <https://www.nytimes.com/2020/04/18/health/cdc-coronavirus-lab-contamination-testing.html>

²² Sources: “CDC Lab Contamination Delayed Coronavirus Testing”. Ashley Yeager, The Scientist. 20 April 2020. Link: <https://www.the-scientist.com/news-opinion/cdc-lab-contamination-delayed-coronavirus-testing-67438>; “CDC’s failed coronavirus tests were tainted with coronavirus, feds confirm”. Beth Mole, Ars Technica. 20 April 2020. Link: <https://arstechnica.com/science/2020/04/cdcs-failed-coronavirus-tests-were-tainted-with-coronavirus-feds-confirm/>; “Coronavirus: How CDC Lab Contamination, And A Failure To Cooperate Globally, Led To Catastrophe”. Anita Bartholomew, Forbes. 19 April 2020. Link: <https://www.forbes.com/sites/anitabartholomew/2020/04/19/coronavirus-how-cdc-lab-contamination-and-a-failure-to-cooperate-globally-led-to-catastrophe/#65df4a155f0b>

States back weeks.”²³ “Limited testing has blinded Americans to the scale of the outbreak so far, impeding the nation’s ability to fight the virus through isolating the sick and their contacts, public-health officials say.”²⁴

By late April, 2019 COVID-19 testing had dramatically increased in the U.S. The CDC indicated, “As of the evening of April 29, the total number of public health laboratories (PHL) that have completed verification and are offering testing is 97.”²⁵ By the end of March, several European countries began purchasing tests from China. Unfortunately, problems soon came to the forefront as medical professionals across these countries discovered significant problems were faulty or only worked when patients were infected for almost a week, impeding early detection.²⁶ The United States Customs and Border Protection reported multiple interdictions of fraudulent Chinese test kits coming into the United States.^{27,28}

Meat and Poultry Processing Worker Case Numbers

Validated data was needed early by decision makers in meat and poultry processing plants, but remained largely unavailable. Aggregate data gathered by the CDC from 9-27 April, 2020 included, “...COVID-19 cases among 115 meat or poultry processing facilities in 19 states....” Although, the CDC stated, “...the crowded conditions for workers in meat and poultry processing facilities could result in high risk for SARS-CoV-2 transmission...” it conceded, “COVID-19 among workers in meat and processing facilities could be due to viral transmission at the workplace or in the community.”²⁹

China’s Obfuscation

China has a history of obfuscating any information it deems potentially deleterious to the Chinese Communist Party (CCP). The SARS-CoV-2 outbreak was no exception. Writing for Bloomberg Magazine, Nick Wadhams and Jennifer Jacobs reported, “China has concealed the extent of the coronavirus outbreak in its country, under-reporting both total cases and deaths

²³ Source: “The CDC Testing Disaster”. David Harsanyi, National Review. 21 April 2020. Link: <https://www.nationalreview.com/corner/the-cdc-is-a-disaster/>

²⁴ Source: “America Needed Coronavirus Tests. The Government Failed.” Christopher Weaver, Betsy McKay and Brianna Abbott. Wall Street Journal. 19 March 2020. Link: <https://www.wsj.com/articles/how-washington-failed-to-build-a-robust-coronavirus-testing-system-11584552147>

²⁵ Source: <https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/testing-in-us.html>

²⁶ Source: <https://www.bloomberg.com/news/articles/2020-04-01/faulty-virus-tests-cloud-china-s-european-outreach-over-covid-19>

²⁷ Source: <https://www.foxla.com/news/fake-covid-19-test-kits-seized-at-lax-by-cbp-officers>

²⁸ Source: <https://www.wmcactionnews5.com/2020/04/08/investigators-feds-say-fake-covid-tests-china-seized-memphis-fedex-facility/>

²⁹ Source: Dyal, Jonathan W., Michael P. Grant, Kendra Broadwater, et al, ‘COVID-19 Among Workers in Meat and Poultry Processing Facilities – 19 States, April 2020, Morbidity and Mortality Weekly Report, U.S. Department of Health and Human Services/Centers for Disease Control and Prevention. May 8, 2020; Vol. 69 (18): 557-561. Posted 8 May 2020. Link: <https://www.cdc.gov/mmwr/volumes/69/wr/mm6918e3.htm>

it's suffered from the disease, the U.S. intelligence community concluded in a classified report to the White House, according to three U.S. officials."³⁰

The lack of candor may have actually started with Wuhan city officials, but was quickly adopted by the CCP, who instituted the practice of parsing case numbers. "In China, only patients showing symptoms and positive results in nucleic tests are included in the official tally of confirmed cases. Asymptomatic patients who have tested positive are monitored and placed under quarantine until they develop symptoms or turn negative in later tests."³¹ The collective effect of this practice made the virus appear to be more lethal (deaths/100,000) than it really is. This seems initially puzzling, until one considers this tactic as potentially being a way for the CCP to justify renewed international travel and economic and diplomatic reengagement with the world, through the "Belt and Road Initiative."³²

China's design to the Belt and Road Initiative (BRI) is to primarily benefit itself. "China has constructed its loosely-governed, \$1 trillion infrastructure initiative to ensure that Beijing reaps many benefits, including potentially, significant foreign dependencies upon China. Most BRI infrastructure contracts are given to Chinese companies, most projects rely overwhelmingly on Chinese labor and supplies, and BRI depends on the availability of massive amounts of cheap credit from Chinese banks."³³

Interestingly, "China's COVID-19 response all but halted the Belt and Road Initiative in several places. Work ceased along the China-Pakistan Economic Corridor, Cambodia's Sihanoukville Special Economic Zone came to standstill, and projects across Indonesia, Myanmar, and Malaysia became stuck in holding patterns. A freeze on the flow of Chinese labor is a significant factor in these disruptions, with thousands of Chinese workers unable to return to their country of work."³⁴

As the Trump Administration made note of China's obfuscation, the CCP reacted by publically admonishing local officials, who they considered might be tempted to hide COVID-19 case numbers. Li Keqiang, a member of the Standing Committee of the Political Bureau of the CPC Central Committee, the Premier of the State Council, and the Central Leading Group for the

³⁰ Source: "China Concealed Extent of Virus Outbreak, U.S. Intelligence Says". Nick Wadhams and Jennifer Jacobs. Bloomberg. 1 April 2020. Link: <https://www.bloomberg.com/news/articles/2020-04-01/china-concealed-extent-of-virus-outbreak-u-s-intelligence-says>

³¹ Source: "China's premier warns local officials not to hide new coronavirus infections". Nectar Gan. CNN. 25 March 2020. Link: <https://www.cnn.com/2020/03/25/asia/china-coronavirus-li-keqiang-intl-hnk/index.html>

³² China's "Belt and Road Initiative" is a massive foreign infrastructure investment project, thought by U.S. and allied diplomats to be designed to entrap Third-World countries in massive amounts of debt.

³³ Lancaster, K. M. Rubin and M. Rapp-Hooper (2020). "What the COVID-19 Pandemic May Mean for China's Belt and Road Initiative". Council on Foreign Relations. 17 March 2020. Link: <https://www.cfr.org/blog/what-covid-19-pandemic-may-mean-chinas-belt-and-road-initiative>.

³⁴ IBID

New Crown Pneumonia Epidemic Work stated, "Every place must seek truth from facts and publicly and transparently release the epidemic information."³⁵

A press release by the CCP provides an interesting context for conjecture, in that it seems to confirm the likely potential for obfuscation, at least at the local level. "Li Keqiang pointed out that at present, most areas of the country have added zero reports of confirmed cases for several consecutive days, which of course is what the people expect. However, it must be remembered that the statistical data of the epidemic situation must be timely, true and accurate, and must not be concealed or missed for the pursuit of zero reports."³⁶

COVID-19 Hits Agriculture and Food

The COVID-19 pandemic caused disruption and volatility in the food production supply chains relatively early after it arrived in the U.S. As the pandemic progressed, social distancing, stay-at-home orders, and business closures signaled the first wave of real impact on food production supply chains. Disruptions also rapidly occurred in retail food, including restaurants where business cratered with the exodus of patrons. Panicked consumers simultaneously rushed to grocery stores across the country to purchase food in fear of lock-down orders and food shortages. Collectively, this caused a pronounced shift in food expenditures by U.S. consumers away from restaurants, where they had in pre-COVID days typically spent over half of their total food dollars³⁷.

The efficiency and productivity of our food supply system was not designed to absorb such a drastic and immediate shift in demand. As a result, short-term food shortages and price increases ensued, while food production remained for a time remained stable. Food supply chains on the other also suffered financial losses, since the restaurants, which had been a lucrative market closed down. Food continued to be produced but had no place to be sent, causing backups in the supply chain. Restaurant closers expanded with the spread of cases. In a report released in March 2020, "The National Restaurant Association (NRA) in the US...warned that the restaurant industry may incur losses of at least \$225bn over the following three-months due to the Covid-19 outbreak. The association, which represents approximately one million restaurant locations, also forecasted that the outbreak can eliminate five to seven million jobs in the same time period. The predictions come as various state governments have banned gatherings and announced large-scale closures to contain Covid-19 virus."³⁸

³⁵ Source: 李克强：各地要实事求是公开透明发布疫情信息，不得瞒报漏报。 www.gov.cn. 24 March 2020. Link: http://www.gov.cn/xinwen/2020-03/24/content_5494917.htm

³⁶ IBID

³⁷ Source: USDA, Economic Research Service, Food Expenditures Series.

Link: <https://www.ers.usda.gov/data-products/ag-and-food-statistics-charting-the-essentials/food-prices-and-spending/>

³⁸ Anonymous (2020) "Covid-19 impact: Restaurant industry may incur \$225bn in losses". VerdictFoodService.com. 19 March 2020. Link: <https://www.verdictfoodservice.com/news/covid-19-restaurant-industry-losses/>

Foreseeing imminent labor issues associated with the growing number of COVID related cases in the US, many of the major meat and poultry processing companies began to offer incentives to keep employees coming to work. The situation changed in early April as the inevitable happened and workers in meat and poultry processing facilities began to test positive for COVID-19. Within days, multiple major processing facilities had temporarily closed and many others were beginning to see large numbers of employees refusing to come to work. As a result, slaughter capacity across the country reduced dramatically.

COVID-19 impacted Food and Agriculture in unexpected ways. There is nothing surprising in the fact that people working within agriculture and food processing were affected by an infectious disease. Agriculture, because of its heavy dependence on human labor was somewhat unique, when compared to other more technologically dependent Critical Infrastructures. When people became ill in the Energy Sector, there were no brown outs. Likewise in the Information Technology Sector, when people became ill, the virtualization of business actually expanded in unprecedented ways. Although, a critical infrastructure, Food and Agriculture was shown to be different. The implications for this are significant, particularly if viewed through the lens of potential strategic effects for our nation. There is no separate food supply for the military. Potential failures in the civilian food supply also meant potential failures in the military food supply. The procurement system that supplies food for our nation's soldiers, sailors and airmen utilizes contracts with the very same food companies that supply the local grocery stores. Although, the military food supply was never threatened, questions emerged on how adjustments could be made, if meat processing closures expanded.

Where from here?

Complexity compounded often reveals flaws in planning and perhaps naiveté in expectations. In this instance complexities compounded, which in turn revealed unanticipated vulnerabilities. Although, it was commonly assumed by multiple administrations that a pandemic would eventually again happen, as it had on multiple occasions, since at least 1918, there appears to have been a major miscalculation by the federal bureaucracy, which assumed that in a public health emergency, China would be transparent, which it was not. Obfuscation by the Chinese enabled the epidemic to go global, not only caused unprecedented suffering, both economically and socially, but it also exposed the weaknesses in our system of government and commerce. U.S. vulnerabilities in this pandemic were put on full display for the world to see, including by several adversarial nations, who would like to collectively neutralize our nation's ability to project economic and diplomatic influence, as well as project force. That element may in the long run be more impactful to our nation than anything else we have experienced in COVID-19. We as a nation clearly need to become more robust and resilient in our ability to protect our Critical Infrastructures and thereby better protect our nation.

Part two of this series will examine more closely how the COVID-19 pandemic took hold in the Critical Infrastructure of Food and Agriculture. It will also further explore the ramifications of the pandemic on agribusiness, food safety, food defense and security.