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Purpose, Process, and Content

During 2019, the Cybersecurity Infrastructure and Security Agency (CISA) sponsored a proof-of-concept project for supply chain resilience in the Puget Sound region. This project was intended to explore strategies and techniques for facilitating supply chain response and recovery following a catastrophic earthquake. Several participants in the 2019 process have suggested that during the winter of 2020, the project's relationships and principles had a practical influence on early private-public collaboration in the pandemic response.

This assessment explores these impressions and possible "unintended consequences" of the 2019 project, and derives potential strategic and operational implications.

This is a retrospective assessment of indirect outcomes that some perceive emerged months after a project conceived for a very different context was completed. This emergence, if valid, coincided with early and uncertain efforts to contain and respond to a global pandemic. At best, this is a highly ambiguous context. To explore these possibilities, we have used case study methods.

Invoking context is a particular purpose of case study methods. Robert Yin has defined a case study as "an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundary between phenomenon and context is not clearly evident."¹

In this case, a boundary that was supposedly closed in late 2019 spontaneously reopened in early 2020 and expanded quickly. A boundary that was originally and rigorously defined for specific Puget Sound geographies suddenly assumed national scope and scale.

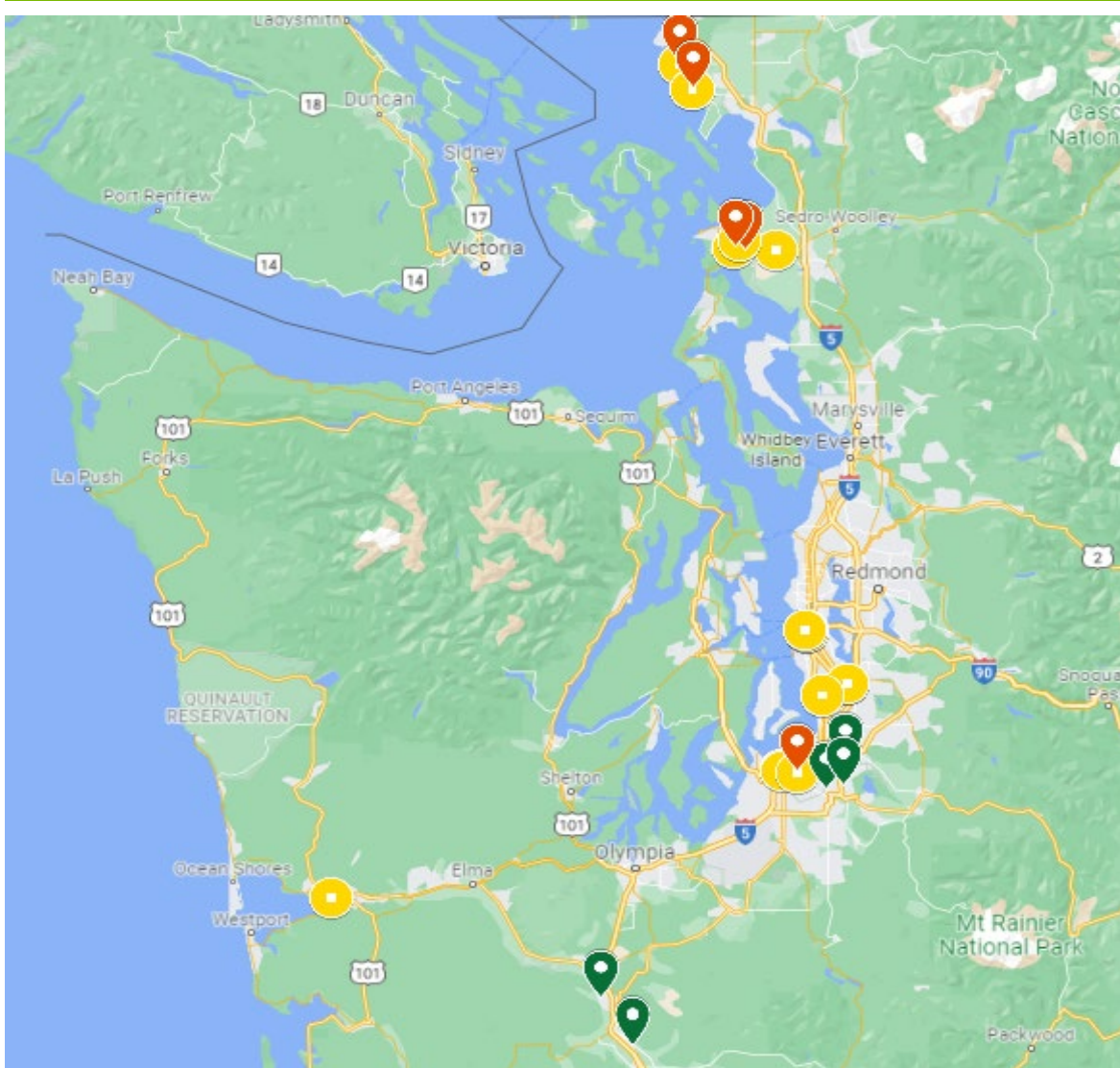
George Alexander and Andrew Bennett identify four strengths of case studies: "Their potential for achieving high conceptual validity, their strong procedures for fostering new hypotheses, their value as a useful means to closely examine the hypothesized role of causal mechanisms in the context of individual cases, and their capacity for addressing causal complexity."²

¹ Robert K. Yin, *Case Study Research: Design and Method* (Sage Publications, 1998).

² Alexander L. George, Andrew Bennett. *Case Studies and Theory Development in the Social Sciences* (MIT Press, 2005).

Case studies tend to be better at asking questions than answering questions. This assessment offers possible answers—but even these answers imply follow-on questions. The assessment is presented in three parts: Case Study: Forming, Storming, Norming, and Performing; Implications and Follow-on Questions; and Origin, Purposes, Methods, and Outcome of the 2019 CISA Project.

Figure 1. Puget Sound’s grocery distribution centers, petroleum refineries, and fuel racks



Note: Green denotes grocery distribution centers serving over 70 percent of Puget Sound demand. Red denotes petroleum refineries serving nearly 100 percent of Puget Sound demand. Yellow denotes fuel racks essential to distributing fuel to nearly 100 percent of Puget Sound demand.

Case Study: Forming, Storming, Norming, and Performing

Washington State's early response to the pandemic

The first recognized case of COVID-19 in the United States was confirmed on January 21, 2020, in Washington state. By late February, there was increasing evidence of community transmission. Until mid-March, Washington had the most confirmed cases of any US state.

The Washington State Department of Health began active surveillance of the novel coronavirus in early January. Interagency consultations on potential effects outside China started in the second half of January. In mid-February, a core group of sub-cabinet officials began reviewing and advancing several non-pharmaceutical interventions (NPIs) consistent with the [2006 state Pandemic Plan](#).

On Wednesday, February 26, Washington's governor directed his cabinet to send appropriate personnel to the State Emergency Operations Center at Camp Murray to engage in urgent preparations for potential epidemic conditions in the state. This whole-of-government effort focused particularly on four NPIs that had not yet been implemented:

- Voluntary or involuntary event closures (also known as NPI 10)
- Voluntary or involuntary public or private targeted site closures (NPI 11)
- Community wide non-emergency travel restrictions (NPI 12)
- Establish a cordon sanitaire (NPI 13; this is essentially a complete lockdown)

Planning and preparedness focused both on (1) how to implement and, if necessary, enforce NPIs and (2) how to reduce the unintended impacts of implementation. Prior worst-case plans developed by the Washington Emergency Management Division and the Washington Department of Health recognized the potential for the most rigorous pandemic response measures to have significant and rapid economic and supply chain consequences.

An early step in the late February planning surge involved discussions with faith communities, especially those involved in food pantry and food bank operations. The state was told that most of these critical gap-filling services would be forced to close within two weeks if food donations from food processors, restaurants, and grocery stores were disrupted. This finding confirmed

the prior economic analysis and clarified how quickly food flows could be disrupted and diminished. Ensuring continued access to food was given enhanced priority.

On Friday, February 28, the Washington State Emergency Management Division, intending to start an ongoing process of communication, sent the following **message to a long list of private-sector organizations**:

Washington State Government is currently weighing 13 sequential interventions (see below) to slow the spread of COVID-19. The key word is weighing options and nothing is being pushed out at this time as an actionable intervention. This message is only to keep you informed of our planning efforts. The State is weighing these interventions against societal and economic impacts. Advanced planning team is working from SEOC. Drafting 13 non-pharmaceutical interventions, or NPIs. NPI 1-9 are already in effect.

1. Increased handwashing and use of alcohol-based sanitizer
2. Respiratory hygiene/cough etiquette
3. Social distancing (> 6 feet)
4. Frequently clean and disinfect personal surfaces
5. Remain home through the duration of respiratory illness
6. Voluntary isolation of sick persons
7. Voluntary quarantine of contacts of sick persons
8. Involuntary isolation of sick persons
9. Involuntary quarantine of contacts of sick persons
10. Voluntary or involuntary event closures
11. Voluntary or involuntary public or private targeted site closures
12. Community wide non-emergency travel restrictions
13. Establish a cordon sanitaire

Request for Feedback

As we ramp up efforts for advanced planning, your input is valuable in helping to shape the information that is pushed out. We need to know your current concerns to better inform our strategy in providing targeted recommendations. If your company has a common theme of concerns pertaining to COVID-19, please send those details to me and I will feed that up to the appropriate entities within the State.

Two questions that tie back to the above interventions are:

1. Are any grocery companies ramping up curbside delivery or have plans that address this approach? This question ties back to intervention 11.
2. What are the plans for event ticketing? This ties back to intervention 10.

THANK YOU! Please do not hesitate to reach out with any further questions. I will continue to keep everyone in the loop as more information is provided.

On February 29, 2020, Washington state announced the first recognized COVID-19-related death in the United States. On the same day, the governor proclaimed a state of emergency.

On Sunday evening, March 1, the Washington State Emergency Management Division sent the following message to several individuals and organizations:

I hope you are doing well. I understand that your company is likely very busy with monitoring and preparing for the coronavirus (COVID-19) as the situation unfolds. The Washington State Emergency Operation Center is continuing to conduct advanced planning in coordination with WA DOH and several other State Agencies. As part of the planning process, we are strategically working through 13 Non-Pharmaceutical Interventions (NPIs)— attached—to identify impacts and measures for impact reduction. Definition of NPI found [here](#). These options are being weighed as tools to slow the spread of COVID-19, but will only be implemented if certain threshold and conditions are met. Decision makers will consider for the broader impact to society and economy alongside the potential public health benefits, so your input is critical.

Your partnership is critical in understanding where certain services (such as curbside delivery) are available, allowing us to understand gaps as we consider the impacts of some of the NPIs. Below are two question sets to help guide the State's advanced planning efforts.

To the best of your ability, please complete the questions below. Any information you are able to provide will be valuable as we develop countermeasures to prevent the spread of COVID-19.

Grocery Questions

1. Is delivery for your customers currently in your business model? Please provide us a list of zip codes within the delivery areas in Washington.
2. Is curb-side delivery currently in your business model? Which locations currently offer this service? Please provide us a list of the stores that provide this service with the address in Washington.
3. Do you have the capability to expand home delivery and curb-side services if needed?
4. Do you have procedures related for delivery and curb-side employee safety and health?
5. Do you have procedures in place to quickly replenish high demand community staples (bread, milk, eggs, water, etc.) when they are at risk of being depleted during certain events (e.g. natural disasters, large social events, holidays, etc.)?
6. What supply chain challenges do you foresee related to possible impacts from coronavirus?

Pharmacy Questions

1. Does your organization currently have an emergency plan in place related to pharmacy operations?
2. Do you currently have procedures in place to ensure the continuity of pharmacy personnel, specifically Pharmacists?
3. Do you offer prescription home delivery services? If yes, does this include all types of prescriptions?
4. If you do offer home delivery services, which geographic areas are currently covered by this service? Please provide zip codes that are currently covered in Washington.
5. Do you have the ability to expand prescription home delivery services, if needed?
6. Does your organization offer drive-thru pharmacy options for customers? If so, which locations offer this service? Please provide us a list of the stores that provide this service with the address in Washington.
7. Does your organization have the ability to establish mobile pharmacies or something similar?
8. What supply chain challenges do you foresee related to possible impacts from coronavirus?

Thank you for your time and energy in protecting the citizens of Washington State.

The distribution list for this email included all those who had participated in two grocery workshops sponsored by the US Department of Homeland Security (DHS), CISA in the second half of 2019. The sender had also participated in these CISA workshops. While the message was sent to many more, a Washington State official explained, “We were basically building on relationships and insights that emerged from those talks with grocery and trucking folks in August and September 2019. We knew we needed to renew that dialogue ASAP.”³ Less than two hours after the email went out, a market-leading grocery firm’s crisis manager responded. The final paragraph in this response noted, “The questions that you are asking, without context or addressing what we would require or need to have in place in order to do so, will not allow any proper response planning. Especially, if this reaches the level of a critical infrastructure community lifeline concern.”

The respondent had participated in the September and October private-public consultations. Behind the scenes, other private-sector participants in the CISA workshops were commenting

³ Unless otherwise referenced, all quotes are from private communication with Philip J. Palin

to each other (but not to Washington State EMD) about “empty outreach” that does not share “any problem-definition” or, in the words of one participant, “without an iota of strategic context.” “Just more noise,” another wrote. The exchange also included government relations and association professionals. One of these inserted the following into the conversation:

Please keep pushing for context and the currently perceived strategic requirements. Over the weekend several folks inside Washington State were pushing for the state to do a better job (for themselves, as well as others) developing a sense of strategic foresight. Then they are pushing to share that what-and-why with you, your competitors, vendors and such to get your input on how to best address the threats and opportunities. They have also been saying that public sector should stay-out of how to solve but be prepared to help whatever the private sector decides is the best approach. This is a current fight inside Washington State—and beyond.

The Friday and Sunday Washington State EMD notes were received by grocers in the context of a sudden demand surge for food across the metropolitan Seattle region. **Most grocery providers reported a 50 percent increase for Saturday, softening to about 30 percent on Sunday.** It was the start of an increased pull on groceries that would persist for many months to come.

Without the August and September workshops, the questions asked might not have been answered. But given the prior engagement and human connections, an informal sense emerged that it was worthwhile to respond and try to reframe the solutions implied by the original question set. So, for example, a March 3 response from a market-leading grocery serving the Seattle metropolitan region included the following:

Delivery or Curb will not be the answer because of sheer volume that is pushed through Brick & Mortar; it is still a small percentage of total product moved—it is not available in all locations. However in this channel:

- All part-time personnel are now working full time
- Curbside orders have doubled
- Delivery has exceeded prior highest orders (Thanksgiving & Super Bowl)
- There is still capacity to do more, but service levels will be impacted

The Washington Emergency Management Division was pleased by the number of detailed responses received to its Sunday night probe. It stated: “We needed to ask the private sector questions. But we could not, especially in writing, get ahead of the Governor on signaling what would be done or how and when it would be done. I understand, now months later, that our early emails seemed presumptuous. But the responses were very helpful, and this first series of Q&A opened the door for continued public-private communication.”

On Wednesday, March 4, at about 4 p.m. Pacific time, the Washington State Emergency Management Division distributed the following message:

This is an update from the Washington State Emergency Operations Center (SEOC). We are currently activated in support of Novel Coronavirus outbreak (COVID-19). Washington state is currently working to plan for the impacts of non-pharmaceutical interventions that may be implemented at the state or local (city/county) level. The interventions under discussion include:

- Voluntary or involuntary closure of events or mass gatherings
- Voluntary or involuntary closure of public or private site closures
- Community wide non-emergency travel restrictions
- Establishing a cordon sanitaire (geographic quarantine)
- The state has not implemented these interventions, but is planning them for use if the situation merits.

We appreciate those of you who have contributed information to our requests to help inform our decision makers. Our objectives in gathering this information are:

- to limit the adverse effect of these interventions on our business community
- to limit the social/economic impact of COVID-19 response efforts
- to ensure critical service providers and critical infrastructure operators continue with uninterrupted operations
- to anticipate potential effects on critical supply chains and work to ensure the public sector is supporting these supply chains

In the event that travel restrictions and/cordon sanitaire is implemented, access to closed areas will be difficult for critical service providers. We encourage you to register your organization with our Business Re-Entry Registration system to assist with identifying personnel critical to your business operations: <https://mil.wa.gov/business-re-entry-registration>.

For now, the best update we have is the attached Situation Report from the State Emergency Operations Center. We recognize that there is a strong desire for actionable information to help business and infrastructure operators plan their COVID-19 response and we will continue to provide updates as information becomes actionable.

Wednesday evening, the [Seattle Times reported](#), “A spokesman for the governor said his staffers, the state health department and the attorney general’s office examined options under the law Wednesday and believe he has the authority to impose travel restrictions or a cordon sanitaire.” Overnight on Wednesday and early Thursday morning, all the grocery participants in the CISA workshops consulted on a joint response to the EMD email. This included

headquarters and local personnel with Albertsons, Costco, Kroger, and UNFI. Outreach was also made to C&S Wholesale Grocers, Walmart, and other national grocery operators who had not participated in the CISA workshops. Also involved were federal, state, and local emergency managers who had been at the CISA workshops and with whom the grocery operators had established positive rapport.

None of those contributing to this overnight consultation could commit his or her organization. But the CISA workshops had incubated personal relationships across the grocery sector and between private- and public-sector professionals that facilitated a quick strategic consensus among these individual professionals. One facilitator for the CISA workshop (who was also known by Washington State EMD personnel) drafted a note reflecting this consensus:

Thank you for warning of the possible restrictions outlined. Clearly, each of the possible measures will have a different impact on the demand and supply network. My responses are intended to help you and your colleagues minimize any unintended secondary and tertiary effects.

If and when the state announces any of these measures, preparatory coordination with key private sector sources of supply is crucial. The extraordinary surge in sales volume over the last six days demonstrates that the population anticipates shortages. Any of these actions will confirm and escalate that anticipation. Any of these decisions will drive sharply increased demand into many more product categories.

Coordinating the timing (even by a matter of hours) and the areas targeted with key private sector providers will help these providers to be as prepared as possible. Right now **an unsustainable hoarding cycle is a real and present danger to the Puget Sound region**. The fewer shortage-signals sent, the more likely the population's hoarding tendency can be contained. There is plenty of supply. But transportation capacity is limited and distances are real. A system-wide simultaneous demand surge cannot be supported without negative consequences on public confidence and the system itself.

As you know, your grocery market leaders are **Albertsons, Costco, Kroger, UNFI (Supervalu), and Walmart**. The readiness of these five suppliers/retailers and their employees, truckers, and vendors is fundamental to the population being fed, continued public confidence, and eventual rapid recovery. I hope you are in ongoing communication with each of these five. In China, the continuity of grocery store operations has been fundamental to otherwise limiting human interaction. Where grocery stores have continued "normal" operations, the public has tended to be more cooperative in quarantine restrictions. Including the private sector in your public messaging plans could be reassuring.

In some places Chinese decisions disrupted effective transportation links for safe and speedy resupply of grocery stores, pharmacies, and other key supply nodes. **Each cordon sanitaire requires a supply line** either touching its edge or delivering into and through the cordon. While it is generally helpful (for

supply chain purposes) to target and shape quarantine zones to be as small as possible, it is important to avoid fragmenting wide-area transportation networks. In China the proliferation of perimeters, related health checks, and similar bottlenecks seriously slowed network-wide supply velocity. In some places this fragmentation essentially eliminated the preexisting demand and supply network...which undermined public health measures as well as the continuity of basic public services.

I hope it will be possible to **avoid cordon sanitaires that encompass Distribution Centers, Fulfillment Centers, and other key supply nodes**. This would have a devastating network effect.

It is important to preserve the **safety and confidence of truck drivers**. Truck drivers may benefit—both practically and emotionally—by being trained in effective risk reduction measures they can take. Working with the suppliers/retailers you may be able to provide non-trucking assets that can maximize the flow of trucks and their supplies. (It is worth remembering that the grocery supply chain depends on truckers and trucking well-beyond branded grocery delivery trucks.) Similar private-public collaboration will be helpful in other ways. For example, in China several effective measures were implemented to ensure social distancing inside retail facilities.

I will mention that the Chinese seemed to have great success supporting continued **operation of the food processing sector**. How they did this is not—yet—clear to me (I regret to confess). This is not irrelevant to Puget Sound where it is estimated between 20 and 30 percent of food has an intra-regional origin. As you consult with your principal food suppliers/retailers, they will be able to involve their most important food processors.

Please articulate public health strategies and objectives in your communications with the private sector. Accurately understanding the right problem-to-be-solved and most important goal-to-be-achieved will allow the private sector to apply their creativity and expertise in working with you. Too often in China authorities made decisions that unintentionally made the situation worse. Again and again, especially as the epidemic spread, authorities fell into “activity traps” meant to show leadership or be reassuring that, in reality, just increased friction across the network and degraded substantive adaptability and resilience. In some cases decisions that were narrowly focused on minimizing the covid-19 risk created new health risks...and a whole series of other stubborn problems that might have been avoided with just a bit broader focus at the start. To explicitly articulate the problem-to-be-solved—instead of assuming a solution—helps avoid this problem.

Quick summary:

- Communicate directly with the principal suppliers of food and other key supplies.

- Develop cordon sanitaires (and other measures) so as to facilitate continued volume and velocity of supplies.
- Schedule and target cordon sanitaires (and other measures) in coordination with principal suppliers/retailers.
- Ensure continued maximum operation of trucks, truck drivers, distribution centers, and related employees.
- Collaborate on problem-analysis and problem-solving. Avoid arbitrary solutions.
- My final strong recommendation: as much as possible **avoid anything that degrades velocity of supply**. There is no current threat to supply volume, but public health measures could seriously endanger velocity...which can generate the same outcome as lack of supply.

This response was received by the Washington State EMD at 7:00 a.m. Pacific time on Thursday, March 5. Internal meetings at Washington State EMD and with other state entities on March 5 included circulation of this response. Thursday afternoon, Vice President Pence visited the Washington SEOC at Camp Murray, Washington. As a result, state-federal communications and coordination were especially active that day. Late Thursday morning (Pacific time), an email from a Washington State official to some of those who contributed to the input to EMD commented as follows:

Your note helped shape an early morning meeting in Olympia. Language from the note has been cut-and-pasted into the State policy document that will be released coincident with the Vice President's visit. Perhaps more important, there was a vigorous discussion of the issues outlined and most, maybe all, of the principals in the State cabinet share the view that "there should be no conflict between effective public health interventions and supplying food to the populace..." This was not nearly so obvious yesterday.

Thursday morning, Washington State public health officials confirmed the 11th COVID-19-related death of a Washington resident. That same day, Amazon, Facebook, Google, and Microsoft encouraged their employees in the Seattle area to begin working from home. In a report on the vice president's visit, the [Seattle Times](#) mentioned, "Across the Puget Sound region Thursday, governments and communities raced to try and stay ahead of developments. Some schools closed out of precaution. Businesses were canceling travel and King County officials urged people to work from home."

Costco is one of the top three grocery providers to Puget Sound. During a long-scheduled [call with financial analysts](#) on Thursday, March 5, Richard Galanti, the Costco chief financial officer, said, "These last nine or so days [it] has been beyond busy," The *Washington Post* reported that "shelf-stable groceries, bleach, paper goods, and even water filtration and food storage systems have been in high demand, and hand sanitizers and cleaning supplies have been hard to keep in stock. In some instances, stores have instituted limits on how many items individual

shoppers can purchase. “We’re getting deliveries daily, but it’s still not enough given the increased levels of demands on certain key items,” Galanti said. “It’s been a little crazy this past week in terms of outsized shopping frequency and sales levels, and not only in the United States.”

The Friday morning, March 6, Washington State EOC Situation Report Number 3 included the following:

Operations staff have been preparing Business Re-Entry procedures to support state and local authorities and encouraging business partners to register with the system. Outreach efforts have focused on informing partners about known planning considerations at the state; gathering contact information and characterizing facilities relevant to transportation critical infrastructure and supply chain nodes. Feedback received from grocery sector partners has been documented and provided to the Operations Section Chief for consideration including:

- Coordinating the timing (even by a matter of hours) of potential closures with key private sector providers will help these providers be as prepared as possible. Right now, an unsustainable hoarding cycle is a real and present danger to the Puget Sound Region. The fewer shortage-signals sent, the more likely the population's hoarding tendency can be contained. There is plenty of supply. But transportation capacity is limited, and distances are real. A system-wide simultaneous demand surge cannot be supported without negative consequences on public confidence and the system itself.
- The readiness of our region's grocery market suppliers/retailers and their employees, truckers, and vendors is fundamental to the population being fed, continued public confidence, and eventual rapid recovery. State and local authorities must establish regular communications with each of these organizations.
- It is important to avoid fragmenting pre-existing transportation networks. A fear is that proliferation of perimeters, related health checks, and similar bottlenecks seriously slowed network-wide supply velocity. This fragmentation would have the potential to destroy the preexisting demand and supply network...which could undermine public health measures as well as the continuity of basic public services.
- Every effort should be made to avoid cordon sanitaire that encompass Distribution Centers, Fulfillment Centers, and other key supply nodes. This would have a devastating network effect.
- It is important to preserve the safety and confidence of truck drivers. Truck drivers may benefit—both practically and emotionally—by being trained in effective risk reduction measures they can take. Working with the suppliers/retailers you may be able to provide non-trucking assets that can maximize the flow of trucks and their supplies.

- Considerations for the food processing sector is critical as it is estimated between 20 and 30 percent of food produced has an intra-regional origin. As you consult with your principal food suppliers/retailers, they will be able to involve their most important food processors.

To the extent possible, the state must articulate public health strategies and objectives in your communications with the private sector.

On March 9, this same language was sent to several grocery operators serving the Puget Sound region as part of an invitation to the first of a series of focused private-public consultations to support the grocery supply chain. The invitation also included these agenda items for the March 11 call:

- Verification of key regional grocery supply chain nodes and transportation routes
- Discussion of credentialing process to facilitate unrestricted movement of goods and personnel supporting the grocery supply chain
- Coordinated public messaging to address consumer hoarding behaviors and concerns around price gouging

One of the private-sector recipients of this invitation (and someone who attended both 2019 CISA workshops) responded by sending his colleagues and competitors a note that read in part: “WA EMD Sitrep listed almost word for word—and in red font—what all of us have been saying these past few years. I too, see this as a win—On the NBEOC call they called out WA as the place to watch. **After we get through COVID-19, we will need to say—it isn’t just for a pandemic.**”

On March 11, the **World Health Organization announced that the COVID-19 epidemic had met the definitional criteria for a pandemic.** Later that day, Washington State convened its first “**public-private grocery supply chain call.**” One participant (who had also participated in the 2019 CISA workshops) indicated that it was one of the most “substantive calls” they had experienced after years in disaster management. They impressed by the transparency of private-sector reports and requests. Grocery supply chain participants were especially concerned about information on school closures, help in diminishing consumer hoarding, and maximizing freight flows through providing hour-of-service waivers and lifting delivery curfew restrictions, and state guidance on store sanitation efforts. During the call, the message was communicated that school closures in metropolitan Seattle were “likely” to be generally mandated “sooner instead of later.” That evening, Washington’s governor banned public gatherings of more than 250 people (NPI 10).

On March 12, Washington’s governor announced that public schools serving the Puget Sound region would be closed starting on March 17. The early notice was intended to assist school staff, working parents, all employers, and especially the grocery sector, to adapt. “We were able

to see it coming,” one grocer commented. “The demand was already so high that I’m not sure it was a practical help but compared to colleagues in other states who were totally surprised by similar decisions we felt like our role was recognized and our needs were being heard, even if not always resolved.”

On March 13, **President Trump declared the COVID-19 outbreak in the United States a national emergency.** Later that day, Snohomish County (Everett) removed delivery curfews for grocery deliveries. Pierce County (Tacoma) did the same, starting on March 16. This had been specifically requested during the March 11 Washington State call with grocers.

The Puget Sound grocery consultations prompted a national **consultation convened by FEMA** on Saturday, March 14. Many issues originally raised during the CISA workshops and by Puget Sound grocery stakeholders were escalated as national priorities. Here is an after-action note for the March 14 call (drafted by a participant in the 2019 CISA workshops):

Today FEMA held a call with the grocery sector during which the grocers expressed significant concerns about being able to keep up with consumer demand. (Demand is 200%+ over the past 16 days, higher for some commodities). They requested assistance with a number of items....Though my list may be incomplete, this does represent the best list available now, recognizing that the concerns/requests are rapidly changing as states / jurisdictions implement new NPIs...

(The Acting Assistant Administrator for Logistics) will be sending these concerns/requests to the FEMA Regional Administrators for discussion with their governors. I also think a letter to all state directors and/or the National Governors Association (and others?) from the business community would be appropriate....The items we captured from today’s call are:

- To continue to serve their communities, grocers are seeking assistance with the following:
 - national waiver of weight restrictions (hours of service waiver was a huge help, but weight allows them to put more on the truck)
 - national waiver of municipal curfews
 - national waiver of delivery hour restrictions (these restrictions are municipal, but a multinational cannot navigate requesting waivers from EVERY jurisdiction)
- EXPLICIT exemptions for restrictions on large gatherings (I know NC has clarified this, a national clarification may be helpful)
- Reasonable and appropriate requirements for deep cleaning if required
- Waivers on fuel restrictions
- Clarity and guidance on access / entry when travel restrictions exist
- Dedicated staging areas for trucks

- Common language from governors on waivers/etc. and state Departments of Health on messages that encourage the community to stop panic buying— Federal govt needs to inspire confidence and reduce fear through the rest of the nation—govt needs to make it clear that they are working with the grocery industry to keep grocery stores stocked.
- Staggering school closures so as to reduce workforce absenteeism
- Prioritization of testing for logistics community
- Assistance with remediation / acquisition of cleaning supplies or companies that can provide cleaning
- Access to hand sanitizer to keep store employees safe
- Clarity on relaxation of privacy / HIPAA requirements if an employee appears ill (especially as sanitation requirements differ for common illness vs. COVID-19)

The next day—Sunday, March 15—several **grocery sector leaders met with President Trump** at the White House. [According to Politico](#):

The Trump administration and grocery industry leaders say the U.S. food supply chain is holding up despite heavy strain amid worries over the coronavirus outbreak, which has cleared out shelves of nonperishable foods, household cleaners and essentials. On Sunday, President Donald Trump held a phone call with food industry executives to discuss how they're managing the growing crisis. Grocers have been reducing hours, deep-cleaning their stores and offering disinfectant wipes to shoppers. They are also limiting purchases per customer of hand sanitizers, toilet paper and other high-demand products. During a news conference Sunday evening, Trump said grocery firms had urged him to communicate the message to consumers to avoid panic-buying. "You don't have to buy so much," he said. "There's no need for anybody in the country to hoard essential food supplies." He claimed there are "no shortages" at stores but people are "buying three-to-five times what they normally buy."

One of the grocery headquarters staff members who had participated in the CISA workshops and pandemic response, including the March 11 and 14 calls contrasted the March 15 meetings at the White House with the March 14 FEMA-convened call: "The White House call just created extra work for those of us supporting the frontlines – it put an issue in front of a group of powerful individuals that are used to thinking out loud and causing things to magically come to fruition....What was valuable was the FEMA call. I saw the influence from their output – even if not entirely well implemented by the states and counties."

During the third week in March (March 15–21), the practical realities of the pandemic began to accumulate. On March 15 indoor **restaurant dining was discontinued** in Washington State (More NPI 11). On March 16, six counties in the **San Francisco Bay Area announced a mandatory shelter-in-place** order to start the next day. Grocery demand in California and

across the nation surged. Many of the Puget Sound grocery stakeholders report that their Bay Area peers were surprised by the first-in-the-nation mandatory shutdown.

On March 17, a subset of participants in the national grocery discussions—all participants in the 2019 CISA workshops—joined a quickly called teleconference on freight movement. There was increasing concern that truck driver fatigue was increasing friction in food flows, causing some delays, and reaching a critical stage given the surging demand for groceries. The discussion included the following:

- States are closing rest areas and limiting the places we can idle and park trucks during rest periods. Many drivers are asking where they can park and have access to restrooms during their overnight trips.
- Restaurant closures are preventing truck stops from serving food—and drivers are complaining that there is no way they can get their rig onto a grocery store parking lot to purchase food right now.
- Some Grocery and CPG Shippers are prohibiting the use of rest room facilities for drivers/however some of those same shippers are delaying drivers 3, 4, 6 hours waiting to load because of the overwhelming volume. We are taking the position of isolating those shippers who are denying basic needs to drivers—and bypassing them altogether. We are not going to put our drivers in that situation.
- Other Grocery and CPG shippers are taking a completely different approach—by continuing to offer ample services to our drivers and even giving our care packages at their facilities. Or, if they are restricting access to restrooms, some shippers are at least providing portable restrooms as an alternative.

On March 19 California instituted a statewide stay-at-home order. Within hours, Illinois, New Jersey, and New York had taken similar measures. Despite these actions, **Washington State did not follow California's lead. On Friday evening, March 20, Washington's governor pleaded for citizens to voluntarily reduce their circulation—but the governor had decided not to impose a similar mandate in Washington.**

During an October 2021 interview, a grocery distributor commented, “I don't know what was behind [Governor] Inslee's decision not to shut-down. But I'm sure it helped us. Demand surged with the California decision and softened with Inslee's delay. Instead of a one-day complete drain, I figure the governor gave us three or four days of high waves, but less than a tsunami. Back then every pallet was precious, still is really.”

Several factors informed Governor Inslee's decision. No single factor was decisive. Influential factors included a March 19 briefing to the governor by the director of the State Emergency Management Division. A quantitative analysis by the EMD had concluded that premature implementation of NPI 12 (stay at home) and almost any implementation of NPI 13 (lockdowns) would have devastating economic and social consequences. A parallel assessment

of qualitative data from supply chain and other infrastructure stakeholders (including participants in the 2019 CISA workshops) reached similar conclusions. Both assessments emphasized not surprising the public or commercial operators. Both quantitative and qualitative data—and consultations with stakeholders—encouraged continued emphasis on voluntary mitigation measures. At the very least, this approach was thought to ameliorate already high demand and help commercial networks prepare.

On March 19, 2020, CISA released its initial [*Memorandum on Identification of Essential Critical Infrastructure Workers During COVID-19 Response*](#). With eight pages identifying such workers across 16 sectors, this document was offered as an initial stab at federal thinking that might be helpful to states. The guidance was explicitly “not, nor should it be considered to be, a federal directive or standard in and of itself.” Rather, the guidance said, the long list was “intended to be overly inclusive reflecting the diversity of industries across the United States.” Included were the following workers in the food and agriculture sector:

- Workers supporting groceries, pharmacies, and other retail that sells food and beverage products
- Restaurant carry-out and quick-serve food operations—carry-out and delivery food employees
- Facilities of food manufacturer employees and their supplier employees—including those employed in food processing (packers, meat processing, cheese plants, milk plants, produce, etc.); livestock, poultry, and seafood slaughter facilities; pet and animal feed processing facilities; human food facilities producing by-products for animal food; beverage production facilities; and the production of food packaging
- Farm workers, including those employed in animal food, feed, and ingredient production, packaging, and distribution; manufacturing, packaging, and distribution of veterinary drugs; truck delivery and transport; and farm and fishery labor needed to produce our food supply domestically
- Farm workers and support service workers, including those who field crops; commodity inspection; fuel ethanol facilities; storage facilities; and other agricultural inputs
- Employees and firms supporting food, feed, and beverage distribution, including warehouse workers, vendor-managed inventory controllers and blockchain managers
- Workers supporting the sanitation of all food manufacturing processes and operations from wholesale to retail
- Company cafeterias—in-plant cafeterias used to feed employees

- Workers in food testing labs in private industries and in institutions of higher education
- Workers essential for assistance programs and government payments
- Employees of companies engaged in the production of chemicals, medicines, vaccines, and other substances used by the food and agriculture industry, including pesticides, herbicides, fertilizers, minerals, enrichments, and other agricultural production aids
- Animal agriculture workers, including those employed in veterinary health; manufacturing and distribution of animal medical materials, animal vaccines, animal drugs, feed ingredients, feed, and bedding, etc.; transportation of live animals, animal medical materials; transportation of deceased animals for disposal; raising of animals for food; animal production operations; slaughter and packing plants and associated regulatory and government workforce
- Workers who support the manufacture and distribution of forest products, including but not limited to timber, paper, and other wood products
- Employees engaged in the manufacture and maintenance of equipment and other infrastructure necessary to agricultural production and distribution

Reaction to identifying “essential workers” became a Rorschach Test of tribal identities. State and local government officials appreciated the help. Across the US, governors’ executive orders and related pandemic statements made regular reference to the CISA list. Meanwhile, members of the private sector tended to roll their eyes. One email venting frustration said, “It’s an interactive network, each piece is needed, nothing is non-essential.” A grocery retail manager wrote, “Right now I feel like day care providers are what is most essential for me to continue operating and I don’t see them on the list.”

On March 20, the [Seattle Times](#) reported, “More than half of the child care programs that are still open are concerned about being able to get basic supplies such as bleach, toilet paper and food. That’s according to a survey of more than 1,500 programs statewide that the nonprofit Child Care Aware of Washington conducted this week.” The newspaper also updated COVID-19 statistics: “The state Department of Health announced 148 newly confirmed cases Friday, bringing the state total to 1,524 cases, including 83 deaths. The bulk of cases remain in King County, which has seen 793 people fall ill and 67 of them die, according to the county’s public health department.”

To quote one Washington EMD staff member, the response to the essential workers list was “overwhelming.” Thousands of emails poured in from businesspeople seeking clarification or appealing their absence from the list. “What was intended to be inclusive was perceived as a radically exclusive,” one trucking executive noted. “The list was just long enough that if you did not clearly see your organization on the list, you assumed you were not. Sometimes trying to

be explicit creates more smoke and fog than being quiet.” Two years later an EMD staffer reflected, “Each word can matter so much more than I realized.” Another state official commented, “Not all synonyms are equal.” A retail association executive agreed and added, “What finally matters most is the preexisting relationship. Where that’s in place, you can get over the other differences. If a human relationship is not in place, each difference is amplified until we are on the edge of a real fight, sometimes over a simple word.”

On Saturday, March 21, FEMA’s Supply Chain Analysis Network released an Ecosystem Assessment for Puget Sound. This analysis included the following:

Based on available data and consultations with knowledgeable local observers, the grocery supply chain in the Puget Sound region is currently serving the needs of the population. After several weeks of extraordinary, sustained high-anxiety consumer demand, supply networks are feeling under sustained attack, but have delivered robust volume and demonstrated significant systemic resilience. A new threat, however, is emerging that will seriously challenge supply chain resilience. **Recent decisions by some major jurisdictions outside Washington State to impose wide-area – even statewide – mandatory shelter-in-place regulations are reducing the volume, velocity and effectiveness of grocery supply chains in those markets.** While the state of Washington has not imposed these measures, it is suffering collateral damage from the related network effects. Similar mandatory measures in the Puget Sound region would further complicate and over-time degrade the flow of groceries that feed the people of the region....While the transmission of covid-19 is implicated, the current threat to grocery supply chains—and other supply chains—is not caused directly by the pandemic. For example, virus-related illness has not yet resulted in significant reduction of the grocery supply chain’s workforce. Rather, the extraordinary level of demand has increased hiring by the grocery supply chain. So far, the force that is disrupting the Puget Sound supply chain is a combination of anxiety-induced consumer demand (aka shopper stockpiling and/or hoarding) and the unintended constriction of supply chains by various social distancing practices. For example, school closings have prompted workforce absences as parents must choose between childcare and work.

On March 23 a **federal emergency declaration for Washington State** was signed by the President. Later that day, after two sessions, the weekly Washington State grocery call was canceled. The function was to be replaced by a call, starting on March 25, hosted by FEMA Region 10 and intended for “local/state/federal emergency management and members of the grocery industry to coordinate operations and communicate issues relevant to the AK, ID, OR, and WA response to COVID-19. This replaces the Washington only and Oregon only grocer calls.”

On the evening of Monday, March 23 the Governor of Washington announced a two-week **stay-at-home order**—“Stay Home, Stay Healthy”—starting at midnight on March 25.

Postscript

In August and September 2019, a set of private-private and private-public relationships were built around an analysis of how grocery flows in the Puget Sound region might be maximized after a catastrophic earthquake. In February and March 2020, these relationships resurfaced to shape how grocery flows were facilitated during a huge surge in demand caused by pandemic-related consumer anxiety. For a few weeks these Puget Sound-focused relationships influenced wider regional and even national processes, policies, and outcomes.

In early May 2020 several participants in the 2019 CISA workshop were asked to reflect on their last few weeks of pandemic response. They agreed, that given the challenges, supply chain outcomes in Puget Sound had been positive—much better than they had seen play out elsewhere. Through a process of one-on-one and group discussion, there was a consensus that the following six factors had been especially important:

1. Puget Sound was the first place in the US with a confirmed case of COVID-19 and a major outbreak. Puget had an earlier, undeniable ramp-up.
2. Despite being first, Puget Sound stayed away from hard shutdowns longer than many places; thus, Puget's supply chain was able to fully flow much longer.
3. The Puget Sound demand and supply network is mostly in one state. The major jurisdictions in Puget Sound coordinated and collaborated more fully than has been the case in other multi-state contexts. As a result, hyper-local supply chain impediments were mostly avoided and flow was not impeded.
4. The targeting of more rigorous Non-Pharmaceutical Interventions for Puget Sound—while avoiding/delaying constrictions elsewhere in Washington State—was a significant support to inbound grocery flows (and contrasts with statewide and multistate restrictions in other regions).
5. Worker absences across the grocery supply chain seem to have stayed comparatively low in Puget, even while they have been much more difficult in several other places (although no one seems sure why).
6. Puget Sound's incredibly bad traffic disappeared. Because Seattle's traffic is usually so very bad, this was much more of a velocity boost for Puget than elsewhere.

In late May 2020, when these consensus assessments were shared with a small group of private-sector competitors, one of those on the call commented that while all these factors were helpful, they perceived that Puget Sound had a head start because most of the people on the day's call already knew each other. They had met at the 2019 CISA workshops, where they had also met several of the public-sector participants who had been involved since the start of

the pandemic. “As a result, I much better understood what we share and depend on as an industry. I also better understood how the public sector wanted to help and could help. I don’t know how we measure it, but I think the six positives listed here depend a lot on the human connections started about eight or nine months ago.” The others agreed that this was a **seventh fundamental factor**.

In October and November 2021, the same private-sector players were asked to review draft versions of this assessment. These active participants in the 2019 preparedness discussions and 2020 crisis pandemic response repeatedly confirmed the essential role of relationships in facilitating a more effective response (or, as one participant argued, facilitating a “less dysfunctional response”).

But after reflecting on results from the vantage of nearly two years on, several participants also pointed to the important role of sharing a data-informed picture of shared flows. “I have participated in lots of disaster workshops that focus on speculative threat outcomes,” one participant noted. “This was the first time I was given a big picture view of supply chain throughputs. The traditional approach describes a problem that can sometimes seem overwhelming. This different approach is much more solution-motivating.” Another participant in the 2019 proof-of-concept emphasized, “We were brought together to react to a set of data that exposed all of us to how much we share. We walked in as competitors. At the end of two workshops, we were still competitors, but we were also given facts, figures, and maps demonstrating that we depend on a lot of the same things. It is in our mutual self-interest to preserve those things. Data alone is probably dead-on-arrival, but when data motivates relationships and the relationships organize around measuring and influencing future outcomes, that’s when data becomes king.”

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Implications and Follow-On Questions

Case studies often focus on a narrow slice of reality even while exploring (implicitly or explicitly) potential principles for much wider application. A single case study is unlikely to empirically confirm wider implications, especially for complex social contexts. But even one case study can clarify working hypotheses for continued examination through other cases and more data-oriented analyses.⁴

An early reader of the Puget Sound case study above commented, “What I take away is the positive potential of unintended consequences when meaningful relationships are anchored in realistic problem-solving. This was much more substantive than the cliché of trade-business-cards-before-the-disaster. This was much more substantive than I-met-you-once-at-a-conference. These were serious people with skin in the game who had previously worked a real problem together. It should be no surprise this helped when a new problem showed up.”

Many participants in the 2019 workshops and subsequent observers perceive that—at least for a few precious weeks—private-public relationships briefly organized around one prospective problem were effectively applied to a very different and urgent problem six months later. If this is accurate, what elements of the 2019 process were key to those 2020 outcomes? Here are some possibilities offered by participants:

1. The 2019 workshops involved strategic decision-makers, leading operators, and recognized near-peers from both private and public sectors.
2. The 2019 workshops were small enough and involved enough face time to facilitate human connections, unveil potential mutual interests, and potentially develop early aspects of trust.
3. The 2019 workshops involved both “objective” outsiders and deeply invested insiders (to whom the outsiders tended to defer).
4. The 2019 workshops focused on a significant, ill-defined, but data-anchored problem requiring creative and strategic thinking; this was not a process of implementing a pre-conceived solution. Participants came away with a shared lexicon and/or an appreciation of the need for a shared strategic perspective and operational lexicon.
5. The 2019 workshops were organized around active, data-informed problem-solving. Several participants contrasted this with more common problem-understanding

⁴ For further consideration, please see [“The Case Study Method in Social Inquiry”](#) by Robert E. Stake.

processes. Instead of focusing on analysis of data-defined problem components, the workshops focused on synthesizing data-informed solutions.

These are not the only potential implications emerging from this case study, but participants frequently mentioned some version of the five characteristics outlined above—and when aggregated as above, can even seem stepwise and cumulative. Individually or collectively, do these constitute a meaningful “working hypothesis” for effective private-public collaboration in supply chain resilience? Does this hypothesis warrant more extended consideration and testing?

The 2019 workshops adapted a 2015 method developed to identify traffic bottlenecks into an approach for mitigating catastrophic failure of wide-area demand and supply networks for food and other life-saving commodities. What structural, functional, or other features allowed this derived method to be useful to the flow of groceries at the start of a global pandemic? What can we learn from mindful and recurring application of this method?

One long-time senior emergency manager involved in both the 2019 workshops and early 2020 pandemic engagement responded to an early draft of the case study with this extended comment:

Public and private sectors are very different cultures but profoundly co-dependent. Contemporary supply chains depend on public investments in ports, bridges, roads and much more. The public sector absolutely depends on the self-organizing adaptability of private sector players to feed millions and foster prosperity by exploiting these investments. Like many co-dependent relationships, these connections are complicated and can be dysfunctional. But private and public need each other. Especially in a crisis, private and public need each other. The worse the crisis, the more they need each other. The challenge is to leverage private-public differences to advance co-creation in a crisis. We talk a lot about trust-building. What the case study demonstrates is how substantively working together before a crisis can encourage reciprocity during a crisis. Trust is built on reciprocity – on meaningful exchange. Despite the 2019 workshops, the first steps in private-public pandemic response misfired. But instead of walking away, both sides chose to continue to engage. They chose to listen instead of dismissing the other. Both sides pushed to clarify, correct, and confirm what they heard. This reciprocal effort to ground-truth complexity and potential mitigation measures helped everyone involved.

Reciprocity is a two-way exchange of roughly equal benefits between two or more supposedly autonomous parties. Outside of major disasters, the profound private-public co-dependence referenced above can *seem* modest, or even minimal. Public-sector emergency managers and private-sector supply chain professionals go about their work with little reason for contact. Even many private-sector crisis managers may have more frequent communications with public-sector emergency managers than with their own firms’ supply chain professionals. But

in a wide-area, time-extended catastrophe, the public sector has a fundamental need for continued flows of water, food, pharmaceuticals, fuel, and other crucial freight and the private sector has an urgent need for public-sector assistance facilitating these flows into and through the affected region. To rapidly achieve reciprocity under duress, it helps to cultivate reciprocal relationships before the hardest part of the crisis hits.

In her [2009 Nobel Prize Lecture](#) (and in many reports of field research), Elinor Ostrom outlines key findings from decades of research on fostering reciprocity to solve a common pool of resource problems: “It is not only that individuals adopt norms but also that the structure of the situation generates sufficient information about the likely behavior of others to be trustworthy reciprocators who will bear their share of the costs of overcoming a dilemma.” She explains that this structure is consistently characterized by the following:

1. Communication is feasible with the full set of participants. When face-to-face communication is possible, participants use facial expressions, physical actions, and the way that words are expressed to judge the trustworthiness of the others involved.
2. Reputations of participants are known. Knowing the past history of other participants, who may not be personally known prior to interaction, increases the likelihood of cooperation.
3. High marginal per capita return (MPCR). When MPCR is high, each participant can know that their own contributions make a bigger difference than with low MPCR and that others are more likely to recognize this relationship.
4. Entry or exit capabilities. If participants can exit a situation at low cost, this gives them an opportunity not to be a sucker and others can recognize that cooperators may leave (and enter other situations) if their cooperation is not reciprocated.
5. Longer time horizon. Participants can anticipate that more could be earned through cooperation over a long time period versus a short time.
6. Agreed-upon sanctioning capabilities. While external sanctions or imposed sanctioning systems may reduce cooperation, when participants themselves agree to a sanctioning system they frequently do not need to use sanctions at a high volume and net benefits can be improved substantially.

This list and the list on page 23 of Puget Sound’s 2020 outcomes are far from identical. The outcomes list is impressionistic, whereas Dr. Ostrom’s list claims a dense web of experiences and empirical clarification. But there are resonances between the two lists worth confirming, clarifying, or correcting. *Something* emerged from the 2019 workshops that, both in real time and retrospectively, struck many participants as constructive. Some of these participants also perceive that the most constructive outcomes were not widely recognized and were unintentionally subverted, and, so, early benefits were not sustained. One participant

commented, “By early May the going-forward process mostly featured one-way communication and no meaningful reciprocity.” Understanding what happened, what did not happen, and, if possible, *why* is worth further attention. As Dr. Ostrom noted later in her Nobel lecture:

We thus face the tough task of further developing our theories to help understand and predict when those involved in a common-pool resource dilemma will be able to self-organize and how various aspects of the broad context they face affect their strategies, the short-term success of their efforts, and the long-term robustness of their initial achievements. We need to develop a better theoretical understanding of human behavior as well as of the impact of the diverse contexts that humans face.

“Maybe it had nothing to do with the workshop methods,” suggested one of the 2019 workshop participants. “Maybe it was just desperate decision-makers leveraging tenuous relationships from six months prior. But at least in my experience, during the first several weeks of the pandemic Puget was the *only* set of local to national private-public relationships that really operationalized around a wide array of policy-strategy-operational-and-tactical options. And, when after a few weeks this process faded, I noticed it was gone and missed it.”

Several of those interviewed for the case study (October and November 2021) mentioned that this was the first time they had been asked to recount what happened during the first few weeks of the pandemic and what they had learned from the experience. For some individuals, this was an emotionally difficult and intellectually complicated task. Many were still uncertain what they had learned or what should be learned.

Ideally, publication of this case study will prompt further self-reflection, shared consideration, and explicit private-public processing of Puget Sound’s (and other examples of) pandemic problem-solving, including the articulation of principles—or at least, proposed principles—of effective private-public collaboration and reciprocity for supply chain resilience. What mix of quantitative and qualitative data offers the most accurate understanding of demand and supply networks? What mix of hard data and softer relationships work best to facilitate supply chain resilience? Despite apparent benefits early in the pandemic, the private-public relationships described in the case diminished after April/May 2020. Why? What was missing (or what was done) to undermine what seems to have been a constructive process? What was lost? What can be done to ensure more sustainable private-public collaboration in the future?

Origin, Purposes, Methods, and Outcome of the 2019 CISA Project

Pre-existing policy context

Commercial conceptualization and operationalization of supply chains *as supply chains* emerged in the late 20th century to achieve production efficiencies, reduce costs, and act as a tool of competitive advantage. Early 21st century supply chain management increasingly focused on velocity of supply to fulfill rapidly proliferating technology-enabled demand signals.

Across these decades, enhanced supply chain efficiencies have tended to result in greater specialization and concentration of sourcing, production, shipping, and distribution capacities within specific product categories, often resulting in deeper dependence on more distant sources of supply. These dependencies (and interdependencies) have prompted gradually increasing attention to supply chain resilience. The supply chain consequences of the 2011 triple disaster in Japan and the devastating floods later that year in Thailand advanced supply chain resilience as an emerging discipline of its own, especially in commercial sectors seeking business continuity insurance coverage.

These substantive trends in supply chains can be discerned in the emergence of US federal statutes, policies, and strategies. For example, the term “supply chain” does not appear in the 2001 [Critical Infrastructures Protection Act](#). In the first [Quadrennial Homeland Security Review](#), published in February 2010, seven of eight references to “supply chains” are focused on potential targets by international terrorists. By January 2012, the [National Strategy for Global Supply Chain Security](#) notes the need:

...to strengthen the global supply chain in order to protect the welfare and interests of the American people and secure our Nation’s economic prosperity. Our focus in this Strategy is the worldwide network of transportation, postal, and shipping pathways, assets, and infrastructures by which goods are moved from the point of manufacture until they reach an end consumer, as well as supporting communications infrastructure and systems.

Still, the December 2012 report [Global Trends 2030](#) by the National Intelligence Council gives little attention to supply chain risk (even as it highlights the risk of global pandemic). At least in the United States, it was the 2017 hurricane season that transformed an anemic understanding of *the* supply chain into a more nuanced understanding of foreign and domestic supply chains (plural) delivering both innate benefits *and risks* and needing smarter public policy attention.

In its [study of the 2017 hurricane season](#), the National Academies of Sciences, Engineering, and Medicine concluded the following:

Disruptions to a supply chain can result from several forces, including **demand shifts** (e.g., spikes in demand for fuel and bottled water), **capacity reductions** (e.g., when a factory or retail store cannot operate due to damage or power outages), and **communication disruptions** (due to loss of cell phone, Internet, or point-of-sale systems). The **resilience of a supply chain depends on how its bottlenecks and lead times are affected** by such disruptions and what capabilities exist for swift restoration after a disruption. The objective of supply chain resilience is to minimize the impact of such disruptions on the affected population. Policies for achieving this objective can be categorized as readiness (mitigation and preparedness actions to help a system avoid and withstand disruptions), response (emergency relief through the establishment of temporary replacement supply chains), and recovery (the restoration of normal supply chain performance through repair of damaged infrastructure, nodes, links). Knowing how to prioritize among these options requires learning from past experiences and developing systematic analyses of supply chain links and nodes to understand their criticality (the extent to which a disruption of the component will degrade the functionality of the network) and vulnerability (the likelihood a node or link will be disrupted). **A node or link that is both critical and vulnerable is a major source of supply chain risk and hence an opportunity for making a supply chain more resilient.** By knowing where bottlenecks are likely to emerge and cause critical supply disruptions, one can identify and prioritize actions to mitigate the harm. [Emphasis added.]

These and related insights from both before and after the 2017 hurricane season contributed to a July 2020 release of the [National Critical Functions](#) that more fully adapts federal policy to supply chain concepts, functions, and experience.

Specific motivation for 2019 Puget Sound pilot

The analytical and decision-support challenges of the 2017 hurricane season were among the factors that resulted in the Puget Sound supply chain resilience pilot project.

The DHS, National Protection and Programs Directorate— succeeded in November 2018 by the Cybersecurity and Infrastructure Security Agency (CISA)—had long engaged in various analyses that touched on supply chains. This work often involved the [National Infrastructure Simulation and Analysis Center](#) (NISAC) and the [Regional Resiliency Assessment Program](#) (RRAP). According to a senior official at NISAC, development of the Puget Sound pilot was “influenced by the 2017 hurricane season, where three hurricanes of national significance (Harvey, Irma, and Maria) had impacted the United States and...many of our capabilities (which

had been designed with hurricanes as a use case) again failed to provide useful information, particularly after the event. We were able to answer questions about what the impacts of a hurricane would be but had very little useful capability that helped to understand anything that happened after the initial “insult” was over—e.g., how dependencies between infrastructure would result in second-order impacts.”

During 2018, NISAC and other NPPD professionals held a series of consultations with several parties, especially focused on how to develop an enhanced approach to anticipating second- and third-order supply chain effects. This included discussions with FEMA, several national laboratories, academic researchers, and private-sector stakeholders.

One issue often referenced during these consultations related to a potentially important **distinction between strategic anticipation that is data informed or data constrained**. In an email, one DHS professional explained that until 2018, NISAC had been committed to “discrete modeling of infrastructure systems that was very data hungry and not scalable and/or large data modeling projects that were based on national-level data and struggled to accurately answer questions at a local level. This would result in multimillion dollar capability development projects where, when we actually encountered an incident, failed to provide useful information to inform decision making.” Was it possible to craft a characterization of reality that avoided this bifurcation and enabled looking around the corner of a potential extreme event? Could the dynamism of demand and supply networks be sufficiently and accurately communicated to inform *both* strategic and tactical decision-making in real time?

By November 2018, a shared hypothesis was beginning to emerge regarding what was missing and how to fill the gap in **strategic anticipation**. Here is an informal description excerpted from emails being exchanged at the time:

Given our concern for delivering content—electricity, communications signals, water, food, fuel, pharma, etc.—we are, of course, interested in the path and intersections along the path and the points (nodes) connected by the path(s). But **MOSTLY we are concerned with flows along whatever path exists to connect supply to demand. We want to sustain or restore and/or redirect flows**. We are concerned about constraints and impediments to flow. We want to do as much as possible to be ready to de-constrain and remove impediments. So...this suggests we need to characterize flow. We need to find where pre-event volume and/or velocity is especially strong and better understand how and why this volume and velocity is achieved. What are the functional modules in the system that facilitate preexisting volume and velocity? By doing this we can begin to discern the sort of post-event functional plus-ups or fixups or other facilitation that is needed.

Many prior analytical inputs focused on outputs. This new focus on flow prompted much more attention to constructing data indicators for inputs, such as the number of available trucks, number of available truckers, where trucks are staged, where truckers live, recent behavior of

the freight spot-market, and other functional elements that frame flow capacity and throughputs. Instead of being constrained by national datasets, there was an interest in exploring non-traditional data sources that could better characterize near-real-time flow potential and behavior and give decision-makers levers to pull that could influence flow. By mid-December 2018, CISA decided to undertake a project that would involve “action-research” to confirm, deny, or clarify the emerging hypothesis.

Original framing of the Puget Sound pilot

On December 17, 2018, the National Risk Management Center (NRMC) at CISA initiated what was by then characterized as a “proof-of-concept” for supply chain modeling and exercising. CNA, a not-for-profit operations research and analysis organization, was contracted to develop and assess the proof-of-concept. In mid-January 2019 NRMC and CNA had reached agreement on purposes and objectives for the proof-of-concept:

- The **purpose** of this project is to engage private sector owner/operators who rely on or support supply chains to develop analytic methods to:
 1. Identify physical and non-physical factors that may limit the capacity of a supply chain to deliver commodities needed to support life-saving in the immediate aftermath of a disaster. This analysis should look at what arrangements in a supply chain are more or less resilient to disruptions, changes in environment, or stress.
 2. Test that analytic method using several case studies, and
 3. Develop useful, scalable analytic methods for the National Risk Management Center that could be engaged to better understand and mitigate those limiting factors.

In mid-January 2019, NRMC and CNA also decided how and where to implement the proof-of-concept. The Puget Sound region was selected based on a comparative analysis of supply chain resilience factors for 59 large US cities and related vulnerability to catastrophic events. An initial focus on water, food, and fuel reflected experiences of the 2017 hurricane season and other extreme events. Five potential modeling methods were examined. A so-called “modified Goldratt” method was set out for testing through the proof-of-concept.

The NRMC had specifically instructed CNA to **review “private sector supply chain modeling methods** and develop a conceptual adaptation of these methods.” In a report to its client, CNA explained the selection challenge as follows:

Arguably the most influential source of private sector thinking about bottlenecks is Eliyahu Goldratt’s “Theory of Constraints”. In Goldratt’s original

1984 text he notes, “What you have learned is that the capacity of the plant is equal to the capacity of its bottlenecks.” But **it has been difficult to translate bottleneck analysis to contexts beyond the scope of an individual company or individual facilities.** The potential for translating bottleneck analysis from “internal” processes (for a single company) to “external” networks (all suppliers of a given commodity in a region) has long been recognized. But practical ability to do so has been frustrated by the lack of network visibility. This is still the case for many supply networks. A recent survey by Deloitte found that, “sixty-five percent of procurement leaders have limited or no visibility beyond their tier 1 suppliers.” Enhanced supply chain visibility – courtesy of Blockchain or other technologies – is emerging but remains complicated and unlikely to be widely achieved for another decade or more. Moreover, commercial operators are primarily motivated to track their own supply networks. In contrast, the **NRMC is concerned with the capacity of wide-area, multi-player supply chains and the emergence of bottlenecks that fundamentally challenge the delivery of life-saving commodities such as water, food, pharmaceutical, and medical goods.** Key interdependencies, such as fuel delivery across supply chains are also of concern. **Where most commercial firms focus on the supply chain for their particular “species,” the NRMC – and others – are concerned for the capacity of the “ecosystem.”** CNA has focused its research on methods of bottleneck analysis effective for wide-area ecosystems of demand and supply. Past research points to the essential lessons for supply chain analysis that should be taken into account when developing a framework for bottleneck analysis. In particular, 1) both network structure and flow are crucial for understanding centrality within the network, 2) supply chains are dynamic and measurement of flow, stocks gives context to network behavior when nodes or link are disrupted, and 3) information flows that express demand are of critical importance to understanding supply chain functioning during disruption.

One of the five methods examined had been set out in a 2015 study for the Federal Highway Administration: the [Freight Performance Measure Approaches for Bottlenecks, Arterials, and Linking Volumes to Congestion Report](#). This generalized approach was adopted as usable and scalable for the purposes of the Puget Sound proof-of-concept. According to CNA: “We have identified several potential methodologies for bottleneck analysis for lifeline commodities in disasters in large urban areas. The recommended approach is to adapt elements of the Federal Highway Administration (FHWA) Freight Performance Measures methodology to develop a data-informed network characterization that helps identify bottlenecks using available data about the network and prioritize based on potential consequences. During the scenario-based exercise, we will test the most effective methodical approaches to isolate bottlenecks in real time and use a modified Goldratt process to sequentially address bottlenecks with the greatest consequence.”

Previous studies have paid detailed attention to Puget Sound supply chains, including a 2011 study by NISAC: [Analytical Baseline Study for the Cascadia Earthquake and Tsunami](#).

Comparing and contrasting this 2011 study and the 2019 proof-of-concept reveals meaningful differences. The 2011 study is much more expansive encompassing thirteen sectors; the 2019 work is focused on water, food, fuel, and related freight movement. The earlier study is mostly an analysis of probable post-event damage; the more recent study is primarily an assessment of pre-event flow capacity. According to the 2011 report, “The basic analytical method employed in this study is to use the direct physical effects (area of seismic shaking, inundation zone) of the scenario events to determine the direct impacts on population and infrastructure. Infrastructure modeling and analysis can then be employed to find the disruptions to services and key cascading impacts. These results will then be employed to estimate impacts to the response environment and the economy.” The 2019 proof-of-concept attempts to identify and prioritize key bottlenecks and think through relationships, operational measures, and mitigation possibilities to exploit bottlenecks in the aftermath of a Cascadia earthquake and tsunami. Both approaches seek to accurately perceive and better understand system effects. But **the older approach is, arguably, organized to scope and scale probable outcomes, while the newer approach is intended to influence possible outcomes.**

An internal CNA email suggesting agenda items for a late January 2019 meeting with NRMIC professionals offered this angle on intention:

Given the horizon of unknowns and uncertainties, I have tried to think through, “What would really help [a senior FEMA decisionmaker]?” A related, but substantively different question is, “What would really help [a different FEMA decisionmaker]?” ...Thinking through what seemed to help in the Anchorage Earthquake, Yutu, Lane, Hector, Michael, Florence, and back in 2017...I keep coming back to very quick flow assessments: How much is moving in what direction how quickly? What he really needs to know is water flow, food flow, and fuel flow. Low or no flows will tell him it is very bad. Strong—even stronger-than-usual flows (ala Puerto Rico)—will tell him he can be strategically and tactically choosy in his response. Credible near-real-time information will give him (et al) the information they need for both assessment and persuasion, and ultimately targeted action. In these prior events he had very little to go on...nothing of sufficient credibility to really strategically commit...and the time-lags for credible data were such that worst-case scenarios needed to be assumed for many the crucial initial decisions. It seems to me that what is described [above] is a very quick bottleneck analysis. Given the typical patterns of pre-event flow, where is the flow diminished or missing or surging? Why? What is the prospect of recovery? Can anything be done to accelerate recovery? Can anything be done to discourage hoarding?

The 2011 study provides national leadership a credible and comprehensive assessment of human, infrastructure, and economic consequences of a Cascadia earthquake and tsunami. The 2019 work is aimed at assisting operational decision-makers recognize opportunities to alter

emerging consequences. Consistent with these differences, **the 2011 study is data driven (even data constrained), while the 2019 proof-of-concept is data informed**—including active sourcing of qualitative data from private-sector supply chain owners and operators.

Given these intentions, the 2019 proof-of-concept included extensive outreach to the private sector. It is meaningful that NRMCM and CNA agreed, “The purpose of this project is to engage private sector owner/operators who rely on or support supply chains...” Initially, this engagement was focused on generating quantitative and qualitative data that could more accurately identify and prioritize potential bottlenecks. **It was also recognized that in the event of a Cascadia earthquake, exploiting bottlenecks would mostly depend on the private sector.** Building private-public and private-private relationships through research and preparedness activities were seen as prerequisites to generate system-wide benefits during response and recovery. The research and preparedness activities would, it was hoped, engender shared understanding of the ecosystem of demand and supply sufficient to support effective interventions and collaborations to influence ecosystem outcomes.

Step-by-step approach of the proof-of-concept

Interplay of research and outreach was fundamental to the methodology being tested by the Puget Sound proof-of-concept. There was—and is—potential tension between rigorous research and meaningful outreach. Systems analysis prefers consistent, well-defined, real-time measures of well-chosen attributes. These are, however, unevenly available for wide-area, multi-player, high-volume, high-velocity, very competitive demand and supply networks. To close this gap, the Puget Sound proof-of-concept initially anticipated a seven-step process adapting the FHWA methodology (see below) that starts with publicly available data sources and then, with Step 4, enters into a very active process of outreach intended to generate quantitative and qualitative data from private-sector owners and operators of supply chains.

Figure 2. Adapting the bottleneck analysis method specified in The Freight Performance Measure Approaches for Bottlenecks, Arterials, and Linking Volumes to Congestion Report (reproduced from a March 2019 planning document)



The March 2019 internal planning document explains, “This is an analytic method that could be used by key network participants—often commercial operators—to self-assess bottleneck propensity in preexisting demand and supply networks. In collaboration with other operators and emergency management agencies this voluntary self-assessment is intended to generate practical insight on potential priorities for enhancing the robustness and resilience of network flows. At this point, CNA is seeking the cooperation of a few network participants to test the analytic method in the Puget Sound region.”

In May 2019, the NRMC received a proposed Framework for Characterizing the Supply Chain Ecosystem for Lifeline Commodities. This document explains:

An ideal analytical model of the demand and supply network for a lifeline commodity would be able to dynamically replicate the flow of the commodity at all places within the analysis area of interest. It would be a perfect digital twin of the real life network. Such a perfect model would be nearly infeasible to create (or would quickly become outdated), but a structured analytical process can build toward such a model, while yielding useful outputs along the way. Within the context of a demand and supply network, several characteristics must be defined to work toward modelling of the supply chain ecosystem. These characteristics include location, capacity, connectedness, and flow. The more robust the characterization of these four characteristics, the better the framework is able to identify bottlenecks....The actual characterization of flow will be a commodity- and region-dependent exercise. Several approaches are valid depending on the data available to modelers. Flow can be determined either at nodes (inbound or outbound) or on links (from node A to B). In many cases, actual flow data will only be available at some nodes, but typical flow estimates based on literature or a subset of data will be sufficient for much of the network. (For example, grocery stores of a specific size class may average a certain number of truck deliveries per day.) Where possible, we recommend trying to measure flow in consistent units throughout the framework, but this may not be possible due to limitations of data.

This “structured analytical process” was conceived as actively involving private-sector stakeholders in confirming, clarifying, or denying what data indicate about locations, capacity, connectedness, and flow. Workshops would be convened where supply chain “insiders” would vet the data-derived flow characterizations, identify the most influential potential bottlenecks, and work-through mitigation possibilities with public-sector participants. The NRMC originally expected to host one or more workshops and tabletop exercises for these purposes. But in early May, the CNA project manager outlined another opportunity:

We have discovered that there is a preexisting, local process for grocery sector outreach occurring in Puget Sound, independent of our work. It involves the city of Seattle, four urban counties, and the state EMA....They are planning a grocery "summit" for this July involving Albertsons, Costco, Kroger and UNFI/Supervalu—who are the "must have" participants, because they account

for more than 80 percent of the regional grocery market....We think this could prove to be a great opportunity to discuss the most significant bottlenecks highlighted in the Task 2 Report. Basically, by attending this summit, we could vet the findings of the Initial Bottleneck Analysis Report, per the task order (task 3.1) AND support a local, organic effort that is working to build ongoing resilience and relationships in the food sector. In preliminary conversations, the local organizers have agreed in principle. Our only hesitation relates to the local's insistence that the July session be super-small. They want the grocery participants to outnumber the public sector participants...so they expect only about 12 to 15 altogether. In exchange for using their meeting to vet our report findings, we have suggested that CNA could follow-up the small July summit with a more inclusive September workshop (task 3.2). The local organizers have agreed—pending private sector interest/agreement at the close of the July session....This helps our project by giving us access to key players in the grocery sector who can vet our report. And it simplifies the logistics of convening the workshop by inviting the participants who are already engaged and committed to the summit process...

On August 7, 2019, a workshop was held at Starbucks headquarters in Seattle, Washington. Research outcomes were presented to representatives of grocery distribution firms supplying over half of Puget Sound demand. Here is the day-after quick report sent to NRMCC:

While the grocery distributors were somewhat reluctant to talk about specifics with respect to the flow of groceries, they agreed with the general proportions outlined in the framework and agreed with the visualizations of the flow of groceries throughout the Puget Sound region...

Overlaying the projected shaking intensity from the Cascadia disaster scenario onto the graphics of the general flow of groceries across the region prompted the participants to start diving into a discussion of resilience and mediation strategies. While there was not much time to do more than scratch the surface, participants seemed eager to continue the conversation at the September workshop...

The one exception to the accuracy of the data relates to the proportion of food products having a local/regional origin (nearly one-half according to FEWSION). This did not seem realistic to the grocery distributors in the room, who felt that this was considerably too high. They did concede that the data could be accurate for fresh meat and produce but was certainly inaccurate for processed foods. Several possible explanations for how the data might be "accurate" but skewed were offered, but there were no obvious answers. For example, one thought was the packaging of bottled water could be skewing the data, since FEWSION tracks commodities by weight (and water is proportionally very heavy as compared to other commodities).

In addition to 12 private-sector participants, 10 representatives of federal, state, and four Puget Sound counties observed, asked questions, and contributed. Facilitation by a civic-sector

leader persistently engaged and focused on the grocery distributors, confirming, clarifying, or correcting the supply chain picture that emerged from the initial research. One grocery participant commented, “This is the first time emergency managers have seemed interested in what grocery does every day and how that might help on a really bad day. I usually get requests to help their supply chains instead of being asked what they can do for my supply chain. Big difference.”

The small August 7 session was followed by a September 12 session to which many more public-sector personnel were invited. The content of the second workshop included a summary of August 7 outcomes (through Step 5 of the framework) and then introduced Steps 6 and 7 by considering whether and how a surviving set of supply chain nodes and functions near Mukilteo Washington could be exploited to reestablish regional grocery flows. Here is a quick internal assessment:

We saw a major shift from maritime and air toward trucks to move volume. At the very least, this seems like a better starting position to the private sector. The private sector did not shut down yesterday like they did toward the very end of August 7 as the public sector began their rituals. Private-Public dialogue was very much engaged. In my opinion [the facilitator] was especially deft following a long public sector discussion of ISBs, FSAs, and so on, turning to the private sector and asking, "Do you care about any of this?" They did not. But that also prompted a good discussion. As that vignette suggests, yesterday's outcomes demonstrate there is a great deal more work to do in Puget Sound in practically aligning private and public. But the method provides a set of flows—and potential impediments—around which private and public can now self-organize.

Participant feedback—both private and public—was positive. The NRMC asked CNA to propose follow-on work. Discussions related to this potential follow-on work were ongoing when, in January 2020, the emerging global pandemic diverted attention.

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