

October 12, 2022

Bay Area Supply Chain Resilience Seminar Series

Supply Chains as a System



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<http://www.bayareauasi.org/sites/default/files/resources/Bay%20Area%20UASI%20FY2019-2019%20Annual%20Report%20Website.pdf>

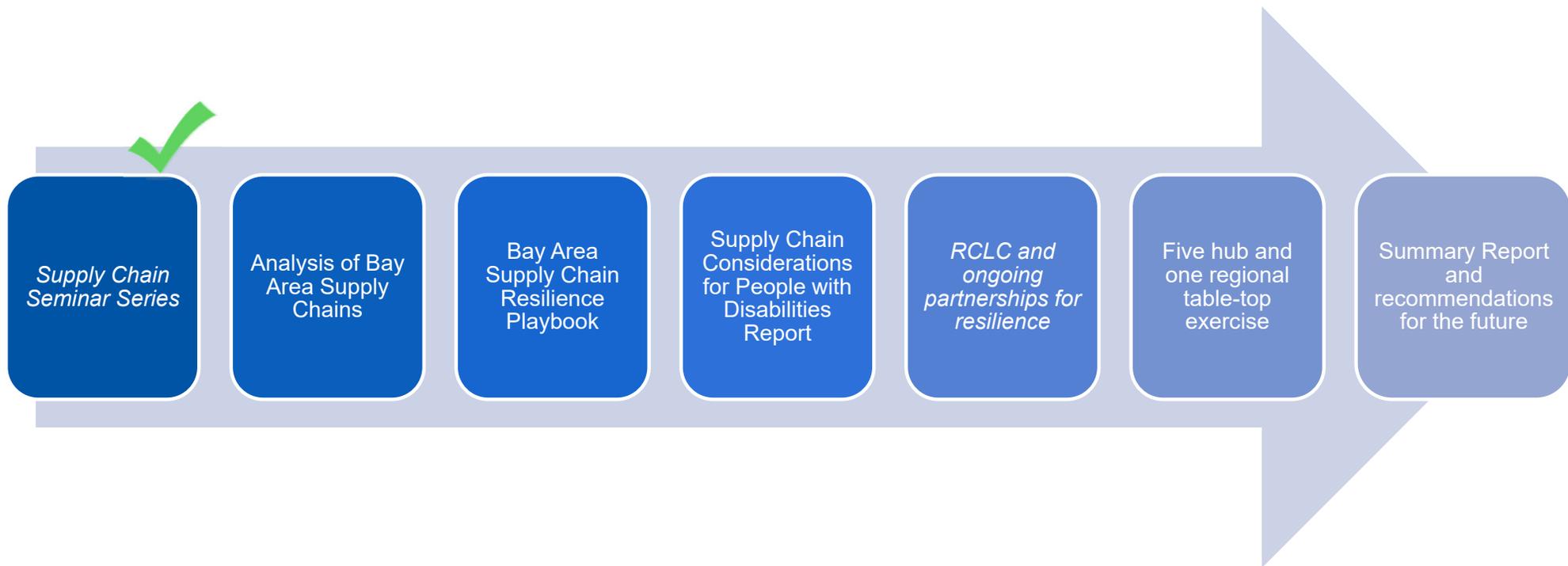
Agenda

- Welcome and Introductions
- What is the Bay Area RCPGP Supply Chain Resilience Grant
- Module I: Fundamental Characteristics of Supply Chains
- Discussion I
- Module II: Structural Challenges of Supply Chains
- Discussion II
- Wrap-Up and Next Steps

Regional Catastrophic Preparedness Grant Program (RCPGP)

- The purpose of the Bay Area's RCPGP Supply Chain Resilience project is to:
 - Improve public/private partnership coordination capabilities for disaster response by enabling the private sector to reconstitute supply chains as rapidly as possible following a disaster.
 - Reduce the impacts of supply chain disruptions on vulnerable populations through the development of guidance and materials to support critical path decision-making and awareness of how people with disabilities in the Bay Area access groceries and food.

What will the Bay Area RCPGP Supply Chain Resilience Grant Produce



Welcome & Introductions

Introduce Yourself in the Chat:

- Name and Jurisdiction/Agency (Organization)

Discussion Logistics

- Please ensure you're muted during the presentation
- *6 to mute/unmute on video Zoom
- During Q&A, please raise your hand to ask a question
- *9 to raise and lower hand on the phone

Module I: Fundamental Characteristics of Supply Chains

For about the next twenty minutes, we will consider:

- What are Supply Chains?
- Demand Pull and Supply Push
- Connecting Demand and Supply
- Nodes, Links, and Interdependencies
- Volume, Velocity, and Flow Capacity

Then another twenty minutes or so will be given to answering your questions.

What are supply chains?

Supply chains are **complex adaptive systems** that target how, when, and where to source and push supply in response to prior, anticipated, and sometimes current pull (demand).

Supply chains involve **logistics** – how to move volume from here to there – but are much more focused on demand dynamics than 5000-plus years of traditional logistics.

Supply Chain Management tries to **calibrate upstream sourcing, midstream movement, and downstream consumption** so that continuous **flow** is as cost-efficient and operationally effective as possible in fulfilling demand and achieving objectives.

Supply Chain Resilience is an emerging practice for **facilitating continuous flow of essential goods and services** (e.g., water, food, fuel, pharmaceuticals, and other critical freight) under severe duress.

Emergency Management roles in supply chain resilience

Pinch-Hitter

Replace flows
MREs
Bottled Water
Feeding Centers
CPODs
Cross-docks
Trucking

Sometimes competes with existing flow

Informer

Roads Open
Grid Status
Telecom Status
Fuel Status
Demand Dynamics

Big Picture

Gap-Filler

Using supply chain informed targeting:

Supplement flows
MREs
Bottled Water
Feeding Centers
CPODs
Cross-docks
Trucking
Fuel

Facilitator

Prioritizing
Debris Removal
Grid Recovery
Fuel Access
More Time
More Weight
Staging/Drop-and-go spaces
Generators
Deconfliction
Demand Signals

Disruptor

Close Routes
Close Rest Areas
Delay
Neglect
Confuse
Mislead
Compete
Delay
Delay
Delay

Demand Pull and Supply Push

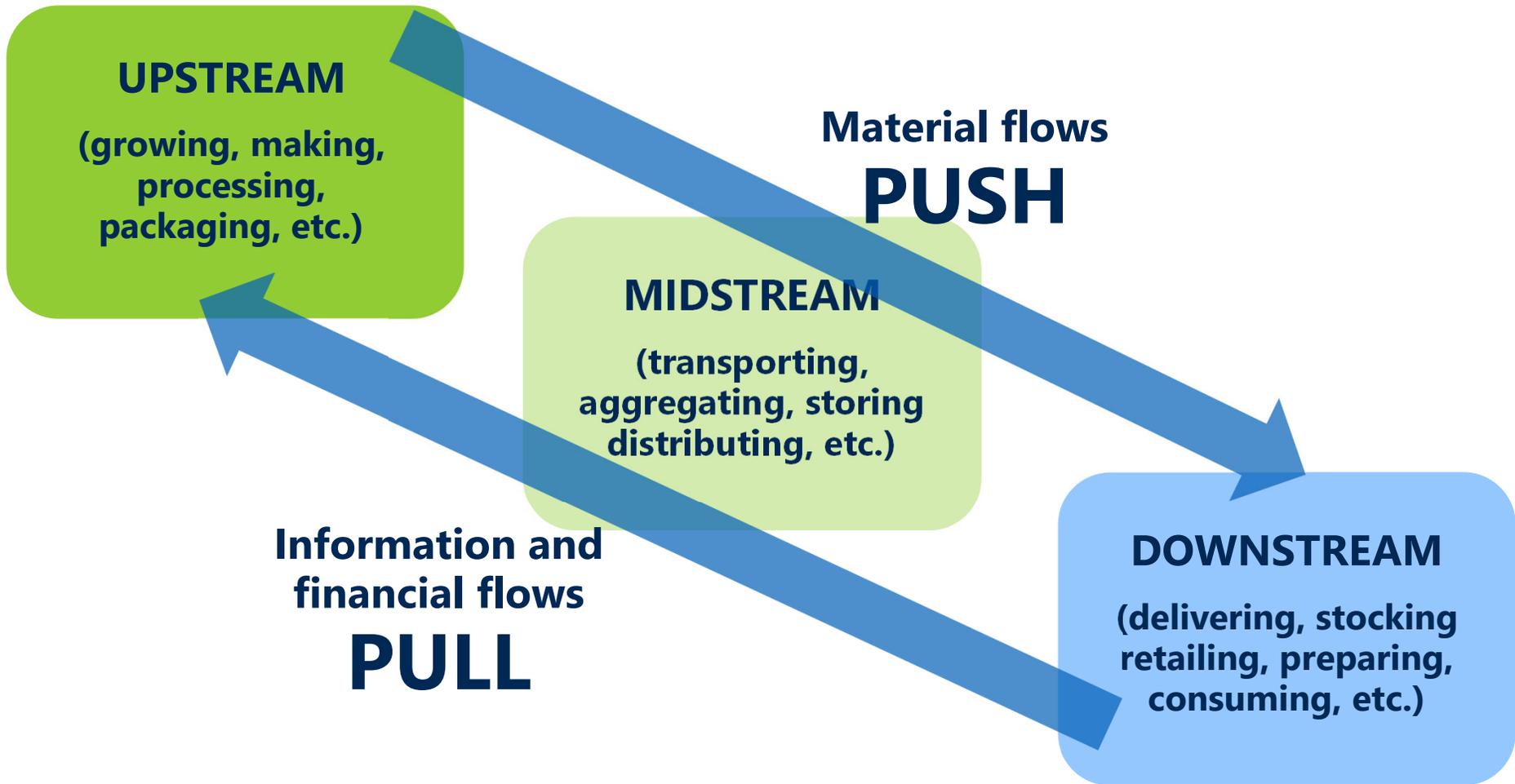
Demand pulls supply

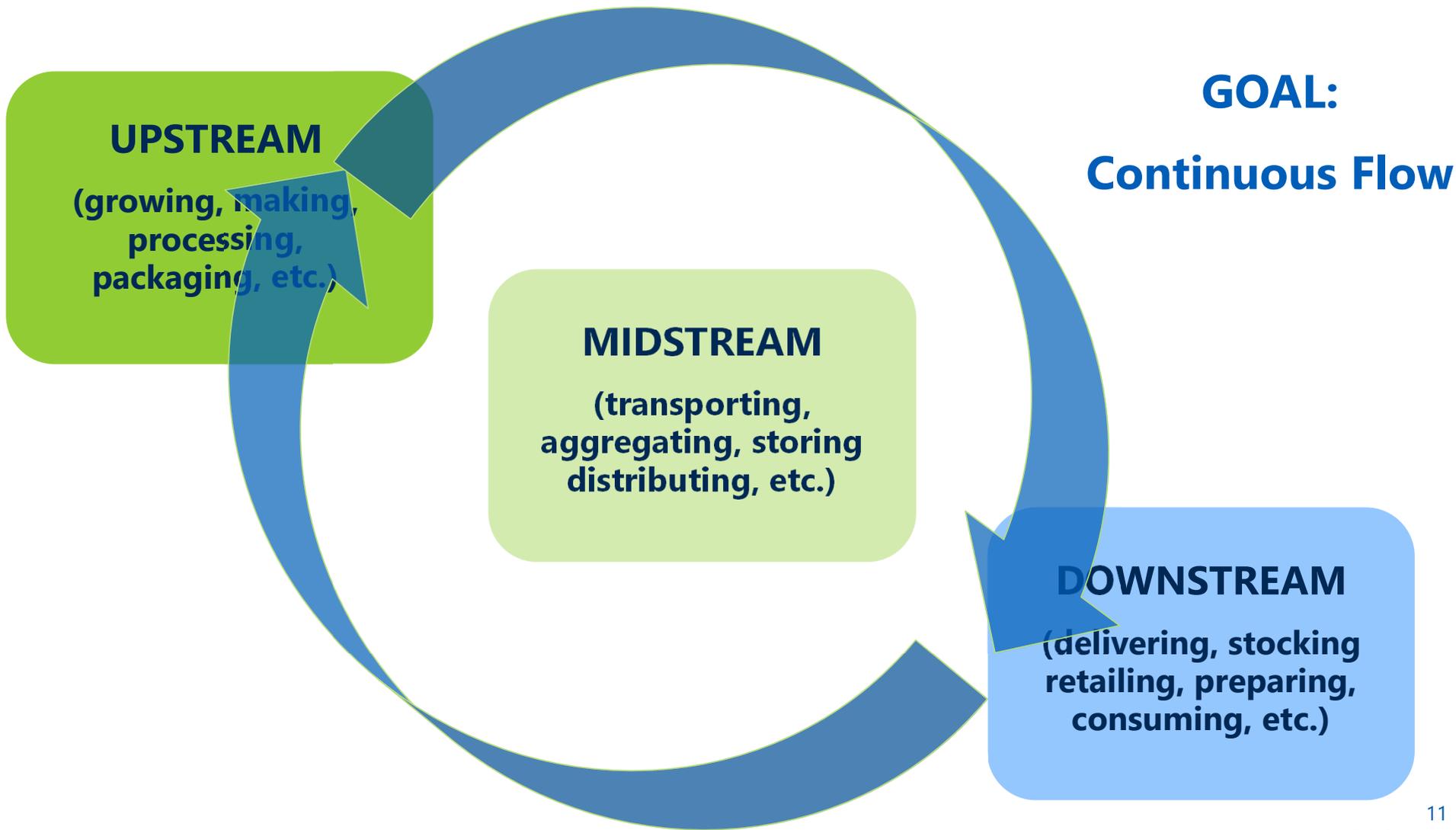
- High vs. low velocity demand (e.g., shopping trips)
- Higher vs. lower marginal demand (e.g., basket size/price sensitivity)
- Dense vs. scattered demand (especially wealth density)

Demand is mostly signaled with credit cards, debit cards, EBT cards, or cash (for food, fuel, and most freight)

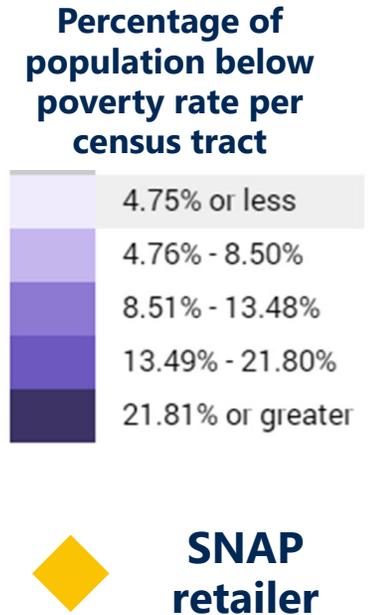
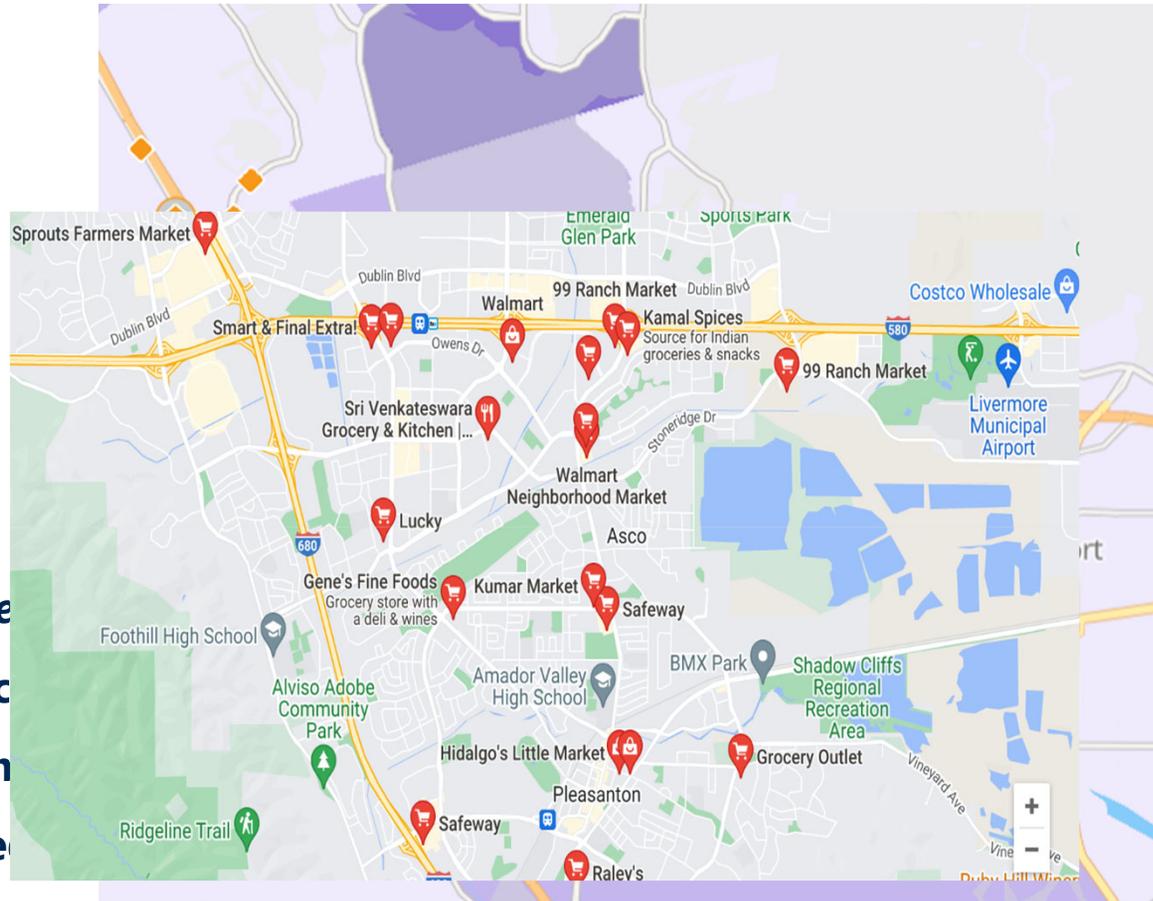
Supply pushes toward demand

- Trucks operating from nodes with aggregated stock (food)
- Pipelines (water and fuel) pump from nodes with storage
- More diverse transportation modes the more distant from demand





Demand variability can cause supply vulnerability



Differentiating De
High vs. low veloc
Higher vs. lower n
Dense vs. scattere

(Dis) Connections

Annual Average Daily Truck Traffic (AADTT)

Rank on top 100 US freight congestion points

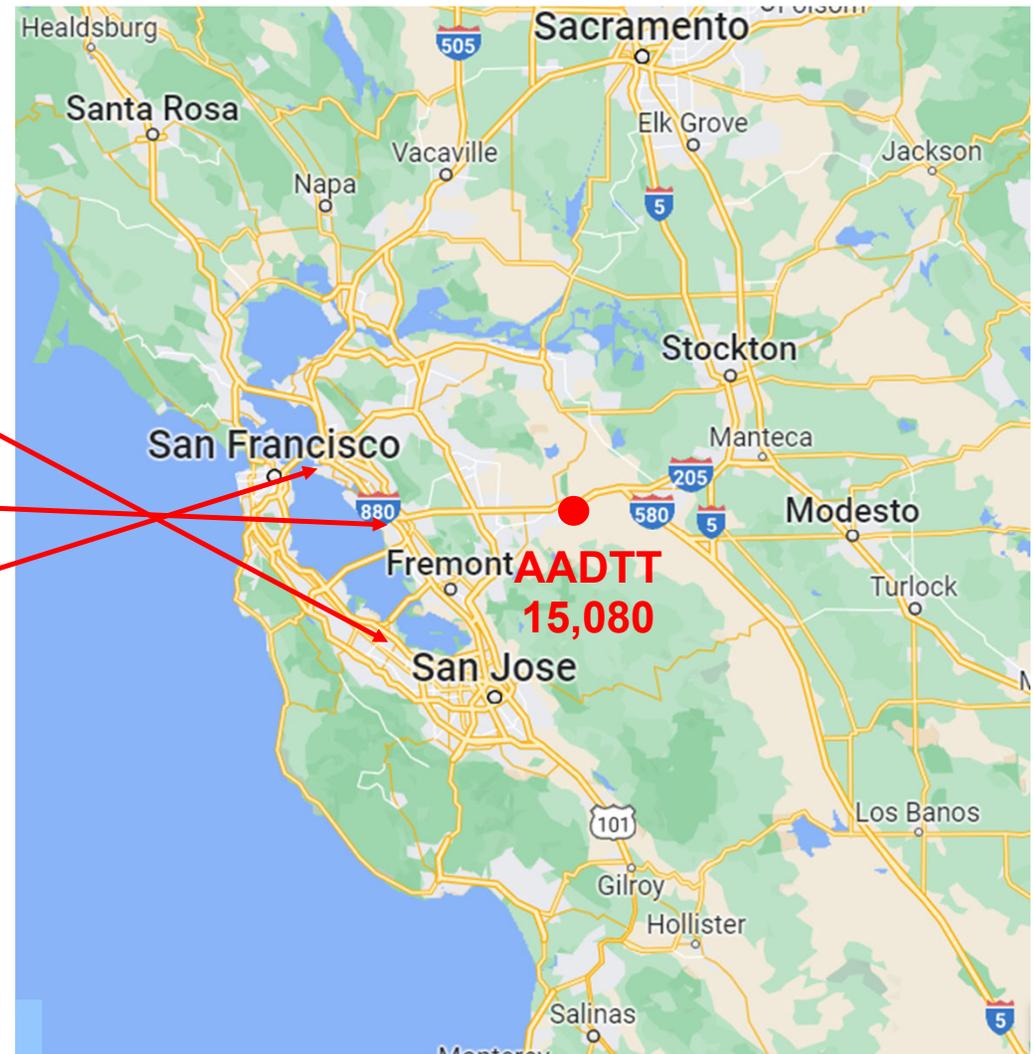
34. US-101 to University Ave, AADTT 5474

52. I-880 to I-580, AADTT 18,052

74. At I-980 and US-101, AADTT 12,070

Nationwide food-related loads represent about one-quarter of total freight value.

Source: National List of Major Freight Highway Bottlenecks and Congested Corridors, Federal Highway Administration (FHWA) Freight Mobility Trends (2019)



Nodes, Links, and Interdependencies

The system's preference for dense, high volume, high velocity demand spawns:

Supply and demand **nodes** where higher volume and velocity can be concentrated to reduce per unit purchasing costs and spread distribution costs across as many units as possible.

High volume, high velocity nodes require high volume, high velocity **links** (aka channels or edges or routes or...)

Highly concentrated nodes and links depend on a vast array of processes operating at scale (e.g., power grid, telecommunications, labor accessibility, truck stops, rest stops, loading docks, etc., etc....). Many of these processes also depend on continued support via nodes and links.

Concentrations

Grocery sales are dynamic and highly competitive. Precise data on grocery flows are difficult to generate. But both published sources and private conversations indicate the following proportions to be roughly accurate for the broad San Francisco Bay area.

- Albertsons (Safeway): 24 to 26 percent of grocery flows
- Super Store Industries: 21 to 23 percent
- C&S Wholesale Grocers: 11 to 13 percent
- UNFI (Supervalu): 11 to 13 percent
- Walmart: 10 to 12 percent

For a total of **77 to 87 percent of total supply** (by value) depending on only five crucial players.



Volume, Velocity, and Flow Capacity

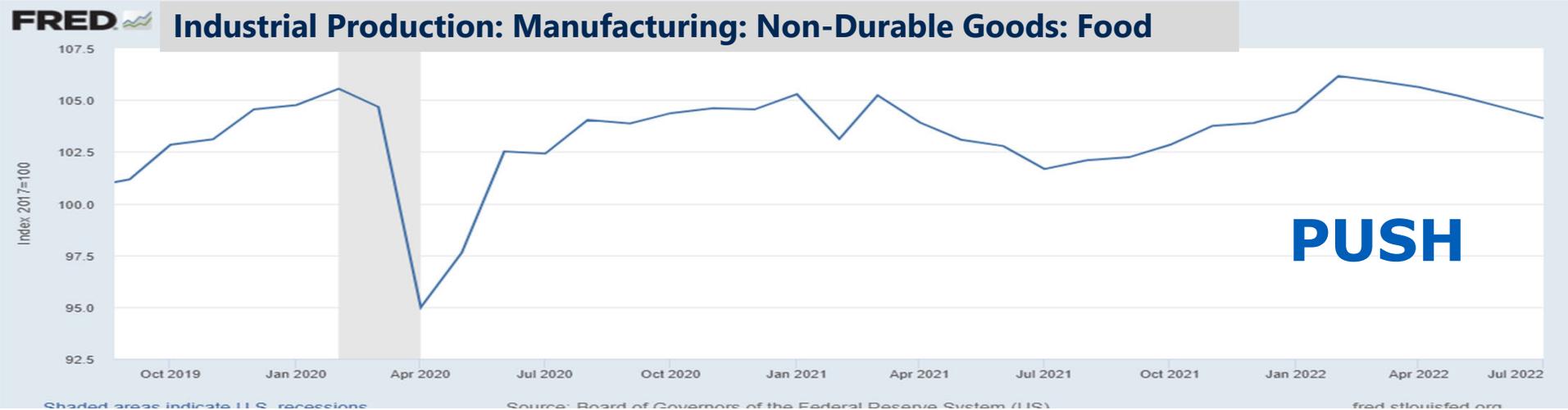
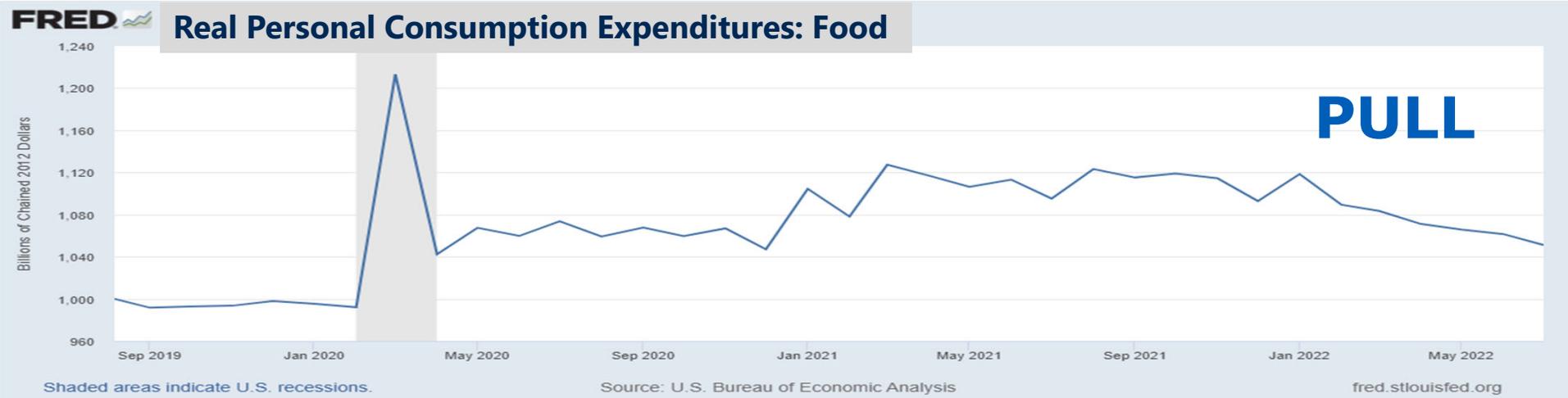
Concentration tends to reward more concentration.

Capacity is increasingly focused on serving the highest volumes, velocities, and financial margins. Recurring, mostly **non-variable flows return higher financial margins** and are much less costly to support at high volumes and high velocities.

Demand **volatility (rapid variability) is usually very disruptive** to supply.

High volume, high velocity **capacity is expensive** – in terms of both time and money – to establish. Rapid shifts in capacity are typically very expensive to engage and will be avoided unless the demand shift is considered to be long-lasting.

Capacity implications of pandemic food demand



A process in a supply chain refers to a production, transportation, or distribution system that makes, moves, or delivers goods and services...

The capacity of a process stage is the maximum rate at which it can produce/move product...

The utilization of a process stage is given by the ratio of demand rate to capacity... Since actual utilization cannot exceed 100 percent, when the ratio is above 100 percent, this indicates the extent to which the resource is overloaded.

Strengthening Post-Hurricane Supply Chain Resilience

National Academies of Sciences, Engineering, and Medicine (2020)

<https://nap.nationalacademies.org/catalog/25490/strengthening-post-hurricane-supply-chain-resilience-observations-from-hurricanes-harvey>

Module I: Discussion

- Raise your hand to ask a question



Module II: Structural Challenges of Supply Chains

In the next ten to fifteen minutes, we will consider:

- Bottlenecks become Chokepoints
- (In)flexible Capacity
- Stress vs. Shock or Stress *and* Shock
- Facilitating Adaptation and Resilience in Catastrophes

Then another fifteen to twenty minutes will be given to answering your questions.



The bottleneck (is) the point in a supply chain that limits its flow (or, more formally, the stage in the system with the highest utilization).

Strengthening Post-Hurricane Supply Chain Resilience

National Academies of Sciences, Engineering, and Medicine (2020)

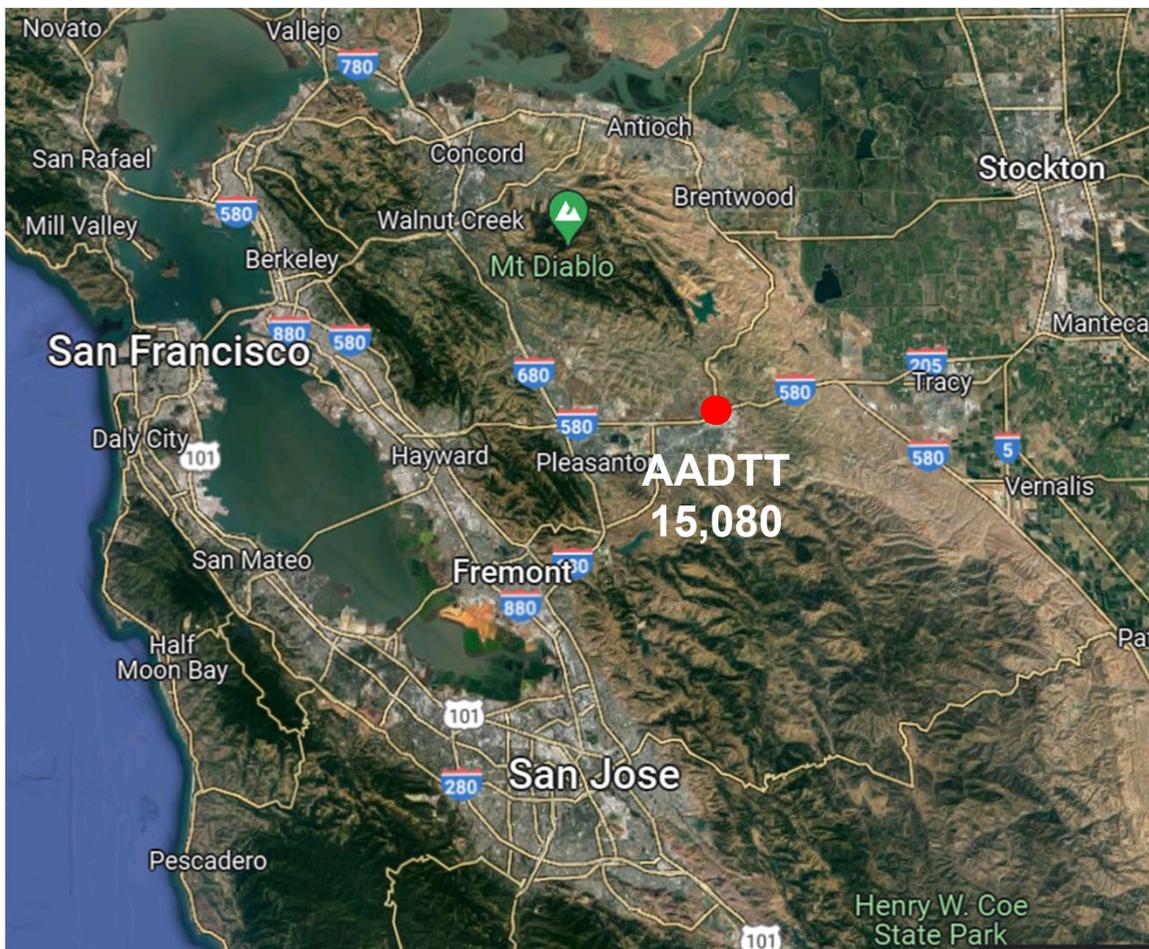
Bottlenecks become Chokepoints



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Bottlenecks become Chokepoints

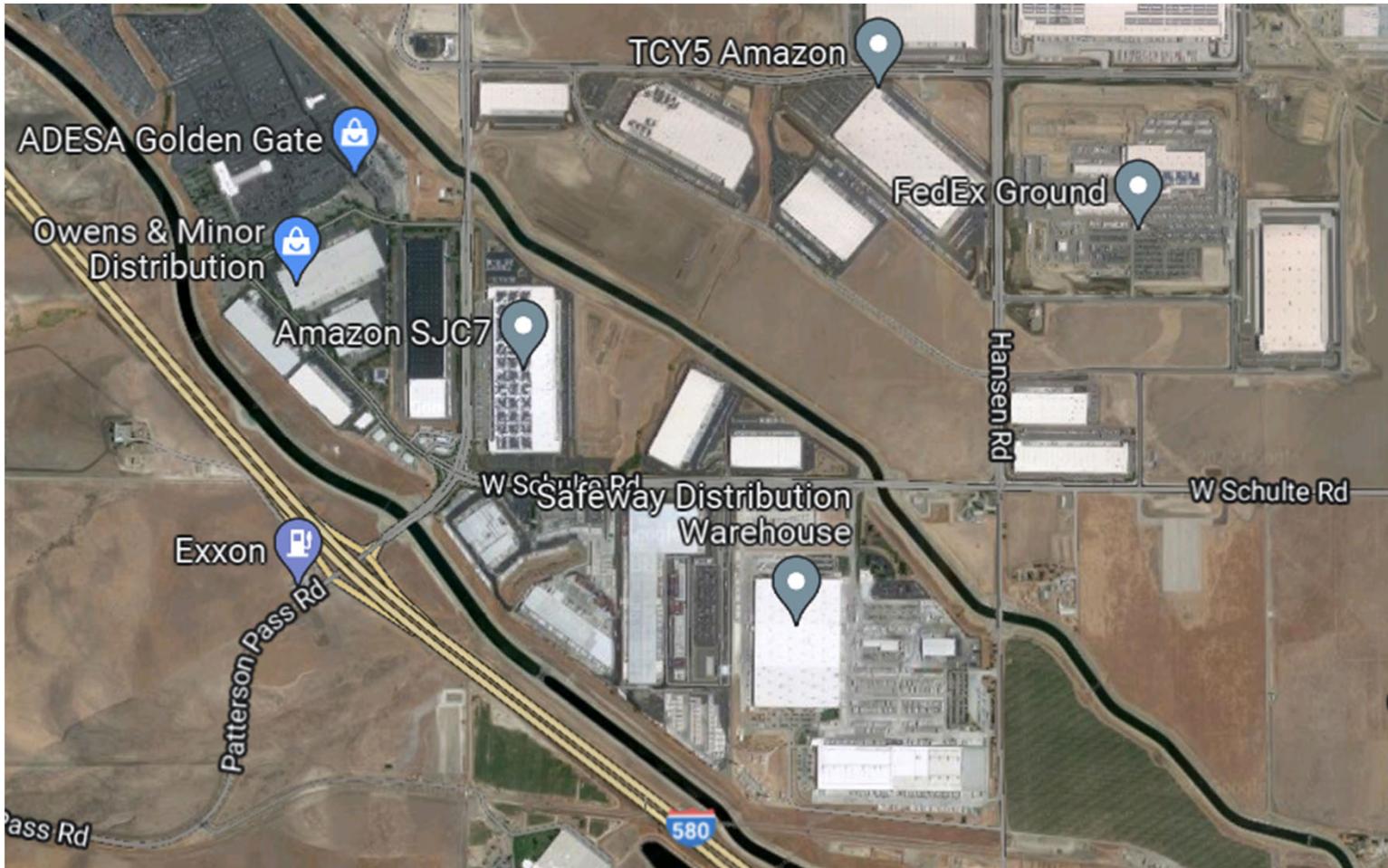


Oakland-Bay Bridge AADTT:6526



San Mateo-Hayward Bridge
AADTT:6370

(In)flexible Capacity

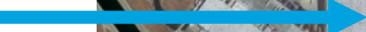


(In)flexible Capacity

Amazon



Costco



Albertsons



FEMA

(In)flexible Capacity

1.33 million cases
distributed through
Government: FEMA,
ARC, DLA



One grocery supplier
surged up to 24 million
cases



Superstorm Sandy Case Study
FEMA Office of Policy, Program Analysis, and International Affairs
(Palin, 2012)

(In)flexible Capacity

Total private sector capacity was more than 50 times public sector capacity



Stress vs. Shock or Stress *and* Shock

Force on target: What kind of force on what kind of target?

- Isolated shock(s) in short period of time: Loma Prieta earthquake
- Accumulated stress(es) over time: California water shortages
- Stresses amplified by shocks: Jackson water crisis, Puerto Rico grid gone
- Shocks initiating long-term stress: 1970s energy-cost transition, pandemic (?)

Stress assessments can help anticipate and size potential shocks. Mature, healthy, high volume, high velocity **demand and supply networks tend to be resilient to narrow-space shocks** – unless that space destroys a significant proportion of demand, distribution, or production capacity. Supply chains tend to shed risk during time-extended stress.

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Demand Signals

Disruptor

Close Routes
Close Rest Areas
Delay
Neglect
Confuse
Mislead
Compete
Delay
Delay
Delay

Module II: Discussion

- Raise you hand to ask a question



Wrap-Up and Next Steps

- Reminder of resources available, suggested readings
- Complete the post-seminar assessment
- Recording will be available
- BA-UASI closing notes

Next Seminar is on **October 26, 2022**

Link to register is in chat