**Introduction**

* (incorporate five minds for the future???).

The sudden increase in prices and continuous stock outs on major markets underscores the function of supply chains that play a big role in the background. Among the growing issues of supply chains circle back to port congestion.

Maritime logistics are mainly managed by ports which is composed of the core of global trade. A port is a place within a harbour where a ship can dock for the purpose of handling commercial cargo or passengers taking care of the ship’s requirements (Pioneer Freight, 2024). Port congestion happens when ships have arrived at the ports but cannot load or unload their containers due to the port reaching its full capacity.

Port congestion has long been known for causing a plague in the shipping industry. When a ship loaded with stacked containers looking like legos, commonly known as the Twenty Foot Equivalent Unit (TEU), fails to secure a spot at ports due to limited berths, shipments get stuck in a limbo causing a disruption in supply chains in various industries that rely on overseas supplies.

* HIGHLIGHT COMPLEXITY ON SC AND IMPACT ON BUSINESS
* INSERT OBJECTIVE OF THE REPORT

**Key Challenge**

In 2020, there was a sudden spike in the number of ships awaiting anchorage in what is known to be one of the busiest ports in North America, Port of Los Angeles. Some cargoes had to wait for a few days or even weeks to empty their ships. While shipping is a key component to the US trade, America has the least efficient ports in the world (ref).

Multiple countries also rely on ports for global trade and port congestion is a key challenge in modern supply chains because when ports get congested, the effects ripple out in all directions that even a small delay can balloon into a major disruption. Soaking up of vessel capacity has tightened the network of the rest of the world that any small disruption becomes a massive problem (Murphy, 2023).

**Evidence**

As ports are a primary international supply chain node, port congestion highly affects the entire value chain (Sinay, 2021). Despite modern ports having a larger capacity to store shipments, the unpredictability of fluctuating rates of imports makes shipments harder to abreast, increasing vulnerability of ports to congestion, resulting in complexity in supply chain management globally.

**[Insert the level of analysis in operations: level of supply network, level of operation, level of process]**

Few of the many causes and effects of port congestion are the following:

**Labor Issues during the pandemic.** While imports coming from Asia entering North America during the COVID-19 pandemic increased to 22% due to increased consumer spending, the pandemic brought an economic halt globally. Lockdowns resulted to restricted economic activities. This significantly reduced the number of port staff that slowed down the turnaround time of cargoes. This inefficiency created a bottleneck that disrupted the flow of goods.

The truckers or drayage drivers transport the containers to short distances from the terminals. The nationwide trucker shortage after the pandemic severely impacted the operations of the ports.According to the Insider News, the US is short 80,000 truck drivers in 2022. Since most drivers are paid per load and not per hour, their long waiting times in the queue, averaging eight hours for five miles, does not justify the compensation they receive. On top of the effects of the pandemic, low pay, poor benefits, and long hours have pushed tons of drivers out of the industry.

**Demand surge.** At the beginning of 2021, the world economy started to recover from the pandemic and countries have managed to resume production. The sudden increase in demand has skyrocketed the level of goods being transported in all directions. However, shipping line operations were still reduced due to certain COVID-19 restrictions that were still present.

U.S. container ports have experienced unprecedented congestion since mid-2020. The congestion is generally attributed to import surges triggered by heavy spending on consumer goods during the COVID-19 pandemic. (Smith, et. al. 2023). The poor demand forecasting during the economic recovery period also contributed to the complexity of handling the influx in the point of entry of imports and exports leading to the congestion.

**Insufficient Storage.** The surge in demand and slow turnaround time of cargoes resulted to the disability of port infrastructures to handle capacity needed. Since many countries have been receiving more imports than exports, empty containers occupy quays while ports are being filled with new cargo.

The Philippine Statistics Authority recently showed the data on the country’s trade deficit wherein the total external trade in March 2024 was $15.44 billion, accounting 60.3% for the imports. This resulted to backlogs due to import containers left empty without having sufficient exports to leave the ports. Empty containers were consuming space in the ports and terminals also increased anchorage waiting time incurring additional costs and pushing freight prices to reach significant figures. Additionally, warehouses where the unloaded goods are stored also experienced operational inefficiency since there are more goods stored than being dispatched. This adds to the vulnerability of the shipping industry to gridlock.

**Equipment shortages.** In addition to insufficient storage, longer duration of ships on anchorage is also caused by lack of equipment to facilitate the movement of containers from unloading to storing. Shortage of Chassis, the wheeled metal framed equipment to support the containers as they are being transported within the terminals also contribute to the congestion. Not all ports are developed and equipped with state-of-art cargo and container handling equipment (reference).

This shortage was also due to the inability of manufacturers to source raw materials on top of the lack of drivers to operate the equipment. The chassis shortage is still an anticipated issue in the many years to come. While manufacturers targeted to produce more than 120,000 chassis to support the shipments in the US, actual estimates only accounted for 80,000, implicating a wide gap between supply and demand. In 2022, the Port of Charleston in the US left over 7,000 containers resting at the port for more than two weeks because of the chassis shortage.

**Extreme weather.** Storms and rough seas can prevent ships from berthing at certain ports or railing out of channels safely (reference). Ships are advised to wait until the weather becomes stable to dock, creating a long queue of ships to enter and leave the port. This pause is unpredictable whether it may be cleared quickly or cause an even longer delay.

In March 2022, Shanghai’s major container port of Yangshan has suspended terminal operations as Typhoon Hinnamor approaches the east China coast (Bloomberg, 2022). This extreme weather affected approximately 75 vessels waiting to dock which caused 3-4 days of delay, incurring an estimated $250 million of economic loss due to the additional fuel costs and shipment delays.

**Proposed Solutions**

Vessel and port congestion in 2021 have become unprecedented, significantly impacting the capacity in the containers, disrupting global supply chains. The impacts of port congestion are far reaching to textile, F&B, energy, healthcare, and other industries resulting to financial strain caused by the slowdown of business. This serves as a wake-up call to the world to address the severe effects of port congestion.

**Leverage on technology and tools.** Miscommunication, data discrepancies,

and delays can lead to underutilized resources and overfilled berths (Curvey, 2023). Investing in technology to automate operations in ports can streamline planning and increase efficiency through maximized utilization of port assets.

Employing predictive and prescriptive analytics will provide better forecasting and volumes of shipment, along with advanced real-time data monitoring in tracking systems to facilitate immediate response to sudden delays. Investing in automation and smart technologies such as automated cranes and robotic systems can maximize the storage capacity of the ports by improving handling throughput. Technology can enhance stakeholder communications and improve collaboration to ensure alignment of plans and strategies. Applying blockchain in their systems to enhance transparency and traceability and Internet of Things (IOT) to keep track of the location and condition of the cargo will mitigate delays and miscommunication. **Streamlining operations will will also reduce financial risks because of better handling. [SEE APPENDIX FOR KRALJIC??? SCOR???]**

By investing on technology and tools, port operations will be systematized. This will enhance the operations, making it more efficient. However, this would require a huge initial cost which might necessitate an increase in port fees, affecting its stakeholders. Integration of technology can also be risky. Employing advanced technologies need additional skills to run port operations. While this may provide more jobs, existing staffs may be resistant to change or consume time to adapt to the skills through training which will impact productivity. Automation will be able to optimize throughput but over-reliance on technology will also impact productivity as technical issues that may arise will disrupt operations and potentially lead to more inefficiencies.

**Diversify and decentralize port operations.** By diversifying and decentralizing port operations, the industry can physically strategize how to alleviate congestion through better cargo traffic management and improved operational resilience.

Utilizing secondary ports for distribution to temporarily ease the cargo traffic will help minimize the burden of congestion on the major ports. Agile supply chains should also be adopted to be able to quickly respond to the delays by providing alternative routes and transportation modes. Organizations should develop alternative shipping routes, lease off-site storage facilities and partner with trucking companies to quickly retrieve containers. In the process, they can sidestep any obstacles that might arise, and keep delays to a minimum (REF).

While utilizing secondary ports can ease congestion, this would increase operational costs and potentially complicate the coordination between these elements of the supply chain such as integrating new technology in multiple ports will be challenging and expensive. Constructing secondary ports also entail environmental impacts. Additionally, when demand is low, these ports may be underutilized, leading to more financial losses.

**Develop contingency plans.** Unpredictable circumstances often place the operations at risk. Backup plans are necessary when dealing with port congestion and container shortages *(reference).* **The port authorities** should develop contingency or buffer plans to manage black swan events and ensure reliable and resilient responses amidst uncertainties.

Utilizing supply chain tools such as descriptive and diagnostic analytics will alleviate issues in forecasts if demand suddenly changes. By analyzing the past business performances and investigating potential patterns or trends, a better overview of the possible implications of disruptions will provide a solid foundation to ensure contingency plans are reliable and that the degree of supply chain responsiveness is consistent with the implied uncertainty.

Comprehensive contingency plans will provide a framework of resiliency towards unforeseen events. However, developing these requires thorough monitoring to stay up to date with potential impacts. This maintenance is associated with additional investments in technology and training to ensure readiness.

Addressing port congestion necessitates diverse strategies. Delivery delays and poor schedule reliability will highly affect consumers, retailers and manufacturers which will lead to significant financial strains. While the total resolution on the issue on port congestion is still a long way to go, initiatives can be continuously developed for as long as potential trade-offs are considered. The persistent results of the proposed solutions highly depend on balancing the trade-offs with strategies that are not only reliable but sustainable as well.

Ports should conduct thorough cost-benefit analysis, enhance stakeholder communication, implement reliable data security measures, and adopt sustainable practices to maximize the benefits of advancing technology in the industry while reducing its risks.

**Conclusion.**

Supply chain analytics aids to develop a structured flow of process, streamline

communication and improves critical and analytical abilities, GOODNIGHT SELF ZZZZ