

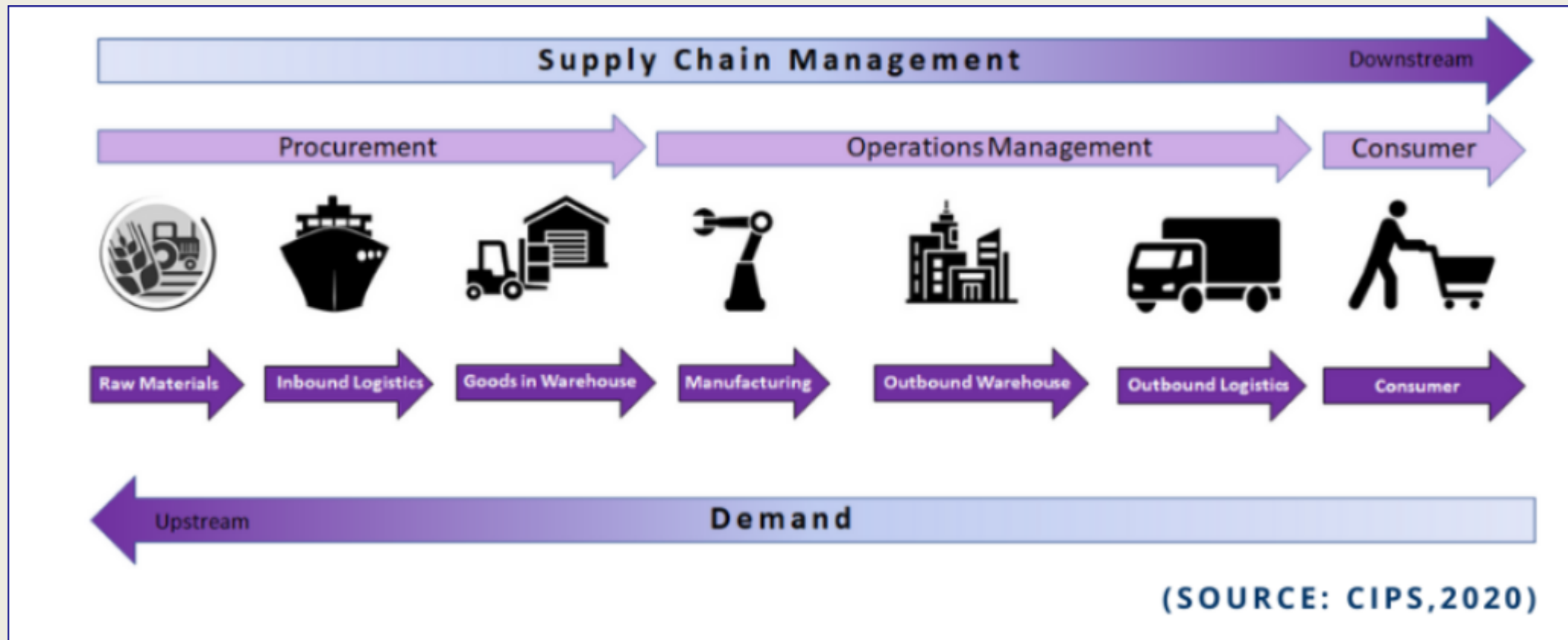
IDENTIFYING SOURCES OF COVID19 PANDEMIC SUPPLY CHAIN FRAGILITY

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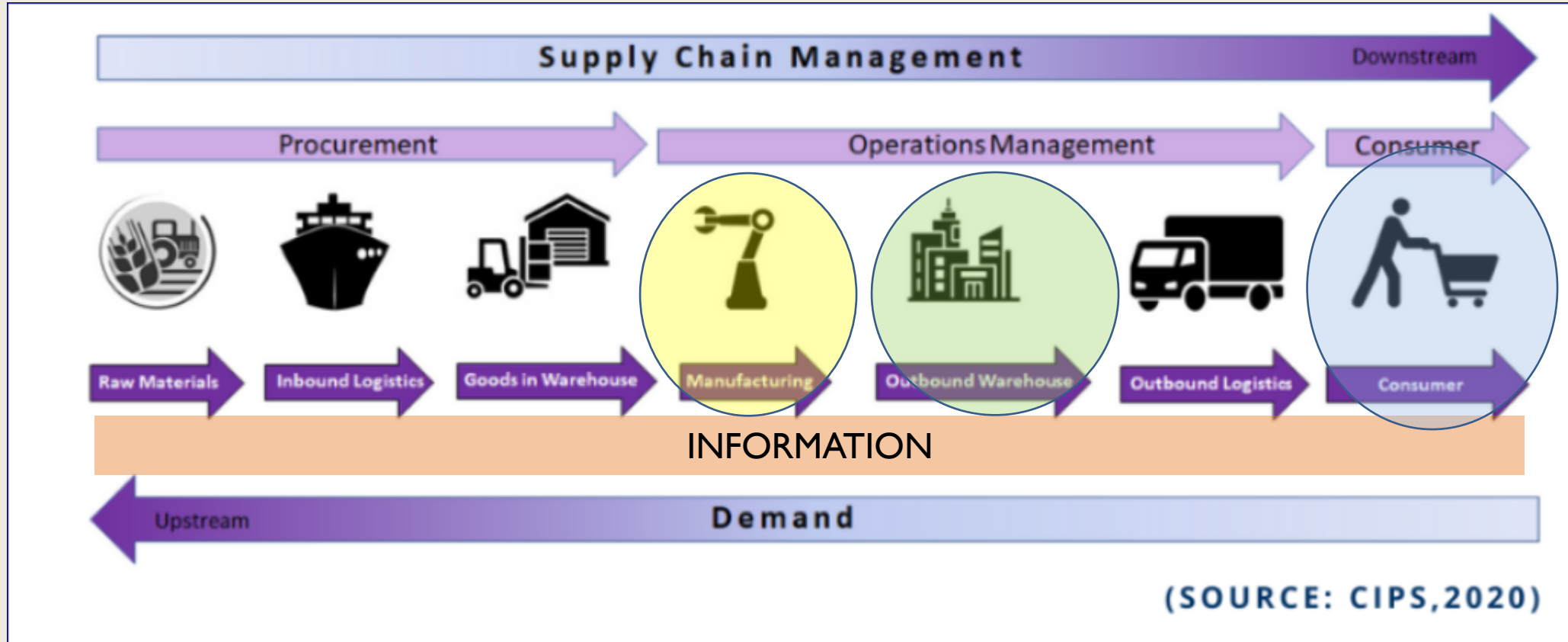
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SUPPLY CHAIN MISTAKES & FAILURES



BACKGROUND

- 95% of US businesses experienced supply chain disruptions (ISM, 2020)
- Examples of issues: vaccine manufacturing & distribution, vaccine hesitancy, distrust misinformation, vaccine equity, hospitals running out of space and beds



BOTTLENECKS ACROSS THE ENTIRE GLOBAL SUPPLY CHAIN

BACKGROUND

- In Feb 2021, President Biden called for a review of COVID 19 pandemic related:
 - Vaccines
 - PPE
 - Medical Equipment
 - Food
 - Semiconductors



HYPOTHESES

1. COVID 19 related **vaccine** product supply chain disruptions are the most frequently discussed topic and concern.
2. **China** is blamed for COVID 19 related supply chain disruptions.
3. **Engineering management strategies** are not mentioned as solutions to resolve the COVID 19 related supply chain disruptions.

METHOD

- Bibliometric review
 - Jan 1, 2020 – Apr 30, 2021
 - Cochrane systematic review
 - *EBSCO Academic Search Complete, Business Source Complete, Newspaper Source Plus and Newswires*
- Began with 167 publications
 - Removed duplicates and irrelevant publications
 - 82 publications selected



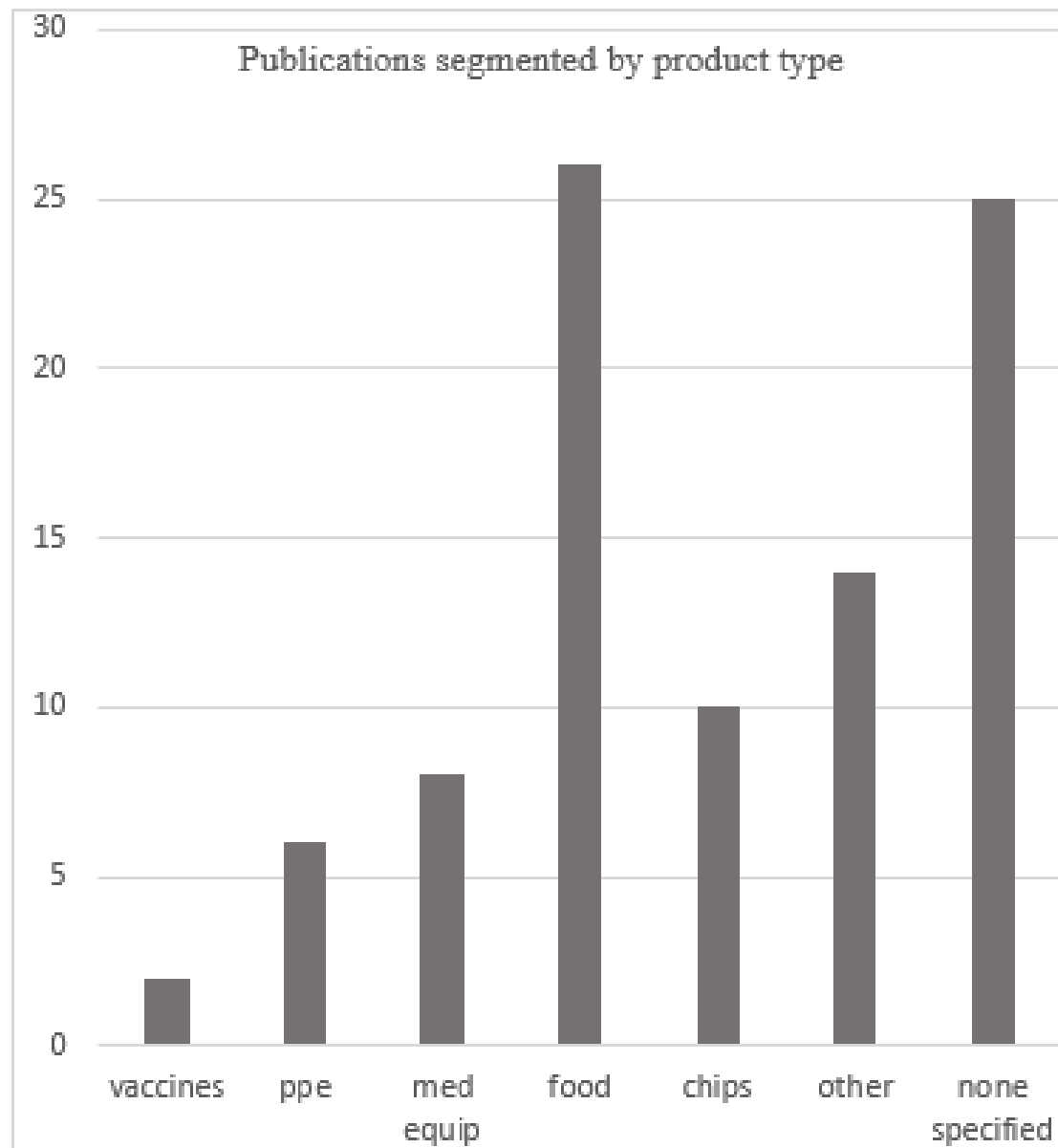
FINDINGS

HYPOTHESIS I – VACCINES

COVID19 RELATED VACCINE PRODUCT SUPPLY
CHAIN DISRUPTIONS ARE THE MOST
FREQUENTLY
DISCUSSED TOPIC AND CONCERN

- Not supported
- Vaccines were mentioned less frequently than food security
- One reason, vaccines were not on the market until Aug 2020

EXHIBIT 1. PUBLICATIONS SEGMENTED BY PRODUCT TYPE





FINDINGS
HYPOTHESIS 2 – CHINA
CHINA IS BLAMED FOR COVID19 RELATED
SUPPLY CHAIN DISRUPTIONS

- China was blamed in 17 out of the 82 publications
- Reasons
 1. US China trade war and tariffs
 2. Concentration of manufacturing in China
 3. How China's lockdown thwarted manufacturing in China
 4. China stopped reduced purchases from exporters

FINDINGS

HYPOTHESIS 3 – ENGINEERING MANAGEMENT STRATEGIES

ENGINEERING MANAGEMENT STRATEGIES ARE NOT MENTIONED AS SOLUTIONS TO RESOLVE THE COVID19 RELATED SUPPLY CHAIN DISRUPTIONS

- Not supported
- Engineering management strategies were mentioned in 49 of the 82 publications (60%)
- 5 topics
 1. Manufacturing locations
 2. Strategic sourcing
 3. Lean manufacturing & Just in Time (JIT) fulfilment
 4. Inventory Management
 5. Digital Data collection
 6. Transportation logistics



20 RECOMMENDATIONS MANUFACTURING LOCATIONS

1. Companies should **diversify the locations** of their manufacturing operations (FitchSolutions, 2020b)
2. Companies need to contrast the cost and efficiency benefits offered by globalized supply chains against more robust, expensive **domestic supply chains**. Domestic supply chains with smaller local suppliers can be risky if their workers get sick during an outbreak like COVID19 (Moyo, 2020).
3. Products that travel longer distances before reaching their final point of sale have more fragile supply chains (Mahajan, 2020). **Reshoring plants** closer to each other to shorten supply chains (Brown, 2020).

20 RECOMMENDATIONS STRATEGIC SOURCING

4. Companies are urged to look at other suppliers in low-cost countries to **move the origin outside China** (Krawcke, 2021).
5. **Need logistics capacity assessments** that include mapping local and international players in the supply chain, their roles, their responsibilities, and their capacities such as warehousing and supplies, and their reputation for having community trust (Koliouis, 2021).
6. **Cloud-based applications that match supply with demand** are useful (PR Newswire, 2020b);
7. **Buyer seller social networking** can help build collaborative partnering relationships (PR Newswire, 2020e).

20 RECOMMENDATIONS LEAN MANUFACTURING & JIT FULFILLMENT

- 8. Revise the supply chain strategy.** For example, prolong the JIT idea within the system and analyze possibilities to configure supply chains based on local suppliers (Marzantowicz, 2020).
- 9. However, be mindful of increasing capital expenditures.** For some manufacturers, a move away from JIT is not likely because of the cost, size, and weight of components such as engines. To move away from JIT would likely increase capital expenditures (Braden, 2020).

20 RECOMMENDATIONS INVENTORY MANAGEMENT

10. “**Safety stock** is no longer a bad thing” because of increased carrying costs. Weigh the increased carrying costs against the potential cost of a stock out (Cassidy, 2021b).
11. Enterprise Resource Planning (**ERP**) **systems** are necessary to predict inventory fluctuations (ERP Advisors Group, 2020).
12. Operations managers **need better forecasting** of customer demand, order volumes and transportation volumes to keep shippers from getting caught with a lot of inventory on hand (Cassidy, 2021b).
13. During COVID19, **tracking information** regarding the **routing of shipments and repositioning inventory** is needed (Koliouisis, 2021).

20 RECOMMENDATIONS
DIGITAL DATA COLLECTION & ANALYTICS

14. Some had to **improve ERP data analytics and sales and operations management (SOPs)**. For example, the US Veteran's Administration quickly realized how antiquated their systems were for tracking medical supplies. They are now planning to modernize their system by 2027 (GAO, 2020).
15. **Data is needed** for supply chain resilience (Saghiri and Bourlakis, 2021).
16. Need more **integrated supply chain planning software** that accommodates when decisions are made and how; at what level of data granularity are decisions made; and how often decisions must be made (Van Hove, 2020).
17. Walmart stated that his team refreshes their supply chain modeling annually. But, with the pandemic, they plan to **accelerate the frequency and speed of their supply chain modeling, network design, and examination of worse case scenarios**. Much can be learned from China (McTaggart, 2020).
18. With digital command center platforms, **reduced document handling and reduced data entry** can increase speed (de Matos, 2020; Cassidy, 2020d). Need a command center with supplier surveillance analytics and the ability to monitor data in real time (Barlow, 2020).

20 RECOMMENDATIONS TRANSPORTATION LOGISTICS

19. Need better planning to prevent delays (Cassidy, 2021b).

- Shippers have had to rethink how they procure freight transportation, i.e., how they put their freight lanes and business out for bid. Traditional practices focused on prices from shipping analysts and trucking executives.
- Rather than arms-length bidding, **more collaborative bidding** has been needed (Cassidy, 2020a).

20. Multi-modal transportation optimization is also needed to enhance speed in finding new freight lanes and new transportation modes (Cassidy, 2020a; Cassidy, 2020e).

NEXT STEPS



- Repeating this study with peer reviewed articles in an expanded number of databases
- We will be done in February 2022

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