Supply Chain Disruptions - Lessons Learned From Previous Natural Disasters

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Supply Chain Disruptions: Introduction

• This webinar is survey of a past few supply chain disruption/s and what lessons, if any, were learnt.

• It is not a primary research webinar, but business perspective of impact of such events.

• Most of the figures, data and comments are based on the following:
  • WTO
  • UN-Comtrade
  • Journals in business like Journal of Supply Chain Management; Production Economics, etc.
  • Trade journals like Wall Street Journal, Forbes
Supply Chain Disruptions: Introduction

• Supply chain management includes the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities.

• This includes coordination with all channel partners and all aspects of demand and supply.

• SCM is a network problem with multiple layers, and goal is to optimize cost, quality, reliability, etc.
Supply Chain Disruptions: Definition

• Disruption
  • **Low Probability Events, High Impact on the supply chain**
    • High probability events can be anticipated, and mitigation can be planned.
    • Low prob, low impact, not necessary to invest much resources.

• Risk factors (what generally literature shows)
  • Natural Disasters—Floods, Earthquakes, Tsunamis, Hurricanes, Fires, Etc.
  • Accidents—Industrial, Nuclear, etc.
  • Infrastructure—IT Systems, Ports, Power, Roads, Etc.
  • Social/Political—Strikes, Trade Wars, Regulatory, Judicial, Wars, Unrest, etc.

• Pandemic/epidemic are not generally considered in literature. This may be
dues to lack of data, very low probability of events, etc.

• COVID19’s impact is probably going to be unique.
Supply Chain Disruptions—Sendai Framework

• UN Framework--The Sendai Framework for Disaster Risk Reduction 2015-2030 (Sendai Framework) was the first major agreement of the post-2015 development agenda and provides Member States with concrete actions to protect development gains from the risk of disaster.—Understand, reduce, & Increase resilience.
Supply Chain Disruptions—Spanish Flu

- Spanish Flu 1918-19
- World War 1
- Huge loss of life
- Economic losses: closes $200 billion
- One of the FED’s studies concluded that economic impact was “short-term.”
- But in early 1900s world trade was not so robust; hence, economic impact of disaster was different then.
Supply Chain Disruptions—Beyond Spanish Flu

• Much larger global trade volume
• More interdependence
• Very competitive environment
• Complexity of supply chain
• Short product lives
• And much more…
Supply Chain Disruptions—Trade

- World Exports in 1913 dollars (1993=100)
- In 2014 it was 45 times higher than 1913 exports
- It has increased another 10%-15% since 2014, i.e., 50 times of 1913 exports.
Supply Chain Disruptions—Economic Data

• 1971
  • GDP $20 T (in todays dollars)
  • Real GDP $3.25 T
  • Population about 3.8 billions

• 2018
  • Nominal GDP $85 T
  • Real GDP $85T
  • Population about 7.7 billions

• 5 decades later
  • GDP is up 4 times
  • Population is up 2 times
  • Exports are up about 10 folds
Supply Chain Disruptions—Merchandise Trade

2015 q1 = 100
Supply Chain Disruptions—Export

Major Exporters in the World

- China: 13.3%
- Germany: 8.8%
- Korea: 8.3%
- France: 3.9%
- Italy: 3%
- USA: 3%
- Japan: 3%
- Hong-Kong: 3%
- Netherlands: 3%
- United Kingdom: 3%
### Supply Chain Disruptions—Manufacturing

Percentage of world manufacturing by top 10 nations (2018, $16 T)

<table>
<thead>
<tr>
<th>Country</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>28.4%</td>
</tr>
<tr>
<td>United States</td>
<td>16.6%</td>
</tr>
<tr>
<td>Japan</td>
<td>7.2%</td>
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<tr>
<td>Germany</td>
<td>5.8%</td>
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<tr>
<td>South Korea</td>
<td>3.3%</td>
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<tr>
<td>India</td>
<td>3.0%</td>
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<tr>
<td>Italy</td>
<td>2.3%</td>
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<tr>
<td>France</td>
<td>1.9%</td>
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<tr>
<td>United Kingdom</td>
<td>1.8%</td>
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<tr>
<td>Mexico</td>
<td>1.5%</td>
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</tbody>
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### Supply Chain Disruptions—China’s Export

**China’s Export**

<table>
<thead>
<tr>
<th>Country</th>
<th>Percentage</th>
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<tbody>
<tr>
<td><strong>United States</strong></td>
<td>6.0%</td>
</tr>
<tr>
<td><strong>Japan</strong></td>
<td>3.1%</td>
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<td><strong>South...</strong></td>
<td>2.3%</td>
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<tr>
<td><strong>Vietnam</strong></td>
<td>3.4%</td>
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<tr>
<td><strong>France</strong></td>
<td>1.3%</td>
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<td><strong>Malaysia</strong></td>
<td>1.9%</td>
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<td><strong>Mexico</strong></td>
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<td><strong>Indonesia</strong></td>
<td>1.8%</td>
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<td><strong>Thailand</strong></td>
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<td><strong>Canada</strong></td>
<td>1.5%</td>
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<tr>
<td><strong>Germany</strong></td>
<td>3.2%</td>
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<tr>
<td><strong>Australia</strong></td>
<td>1.9%</td>
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<tr>
<td><strong>Spain</strong></td>
<td>1.0%</td>
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<tr>
<td><strong>United Arab...</strong></td>
<td>1.2%</td>
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<tr>
<td><strong>Saudi Arabia</strong></td>
<td>0.72%</td>
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<tr>
<td><strong>Chile</strong></td>
<td>0.65%</td>
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<td><strong>Iraq</strong></td>
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<td><strong>Iran</strong></td>
<td>0.65%</td>
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<tr>
<td><strong>Ukraine</strong></td>
<td>0.65%</td>
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<tr>
<td><strong>Panama</strong></td>
<td>0.72%</td>
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<tr>
<td><strong>Greece</strong></td>
<td>0.73%</td>
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<td><strong>Peru</strong></td>
<td>0.73%</td>
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<tr>
<td><strong>Hungary</strong></td>
<td>0.72%</td>
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</tbody>
</table>
Supply Chain Disruptions—Trade US-China

US-China Trade ($000,000)

Exports
Imports

Supply Chain Disruptions—Some Disruptions in 2000s

• 2001 9/11 terrorism
• 2004 Indian Ocean Tsunami
• 2005 Katerina
• 2008-09 Great recession
• 2011 Japanese Tsunami
• 2011-12 Flood in Thailand (industrial area)
Supply Chain Disruptions—Some Disruptions in 2000s

- 2001 9/11 terrorism—$100 b+
- 2004 Indian Ocean Tsunami $10 b
- 2005 Katerina $82 b
- 2011 Japanese Tsunami $275 b
- 2011-12 Flood in Thailand (industrial area) $4-6 b
Supply Chain Disruptions—Tsunami 2011

• Most studied supply chain disruptions (low prob/high impact)
  • Large financial damage
  • Worldwide impact
  • World’s premier car company, Toyota, was impacted the most
  • Systematic response to recovery from Tsunami
  • Longest of the other low probability-high impact disruptions until then
  • Generally disruption impact on supply last about 1-2 weeks
  • Japanese Tsunami -3 weeks to a few months
Supply Chain Disruptions—Tsunami 2011

- Iryou—Medical devices
- Kenki—Construction equipment
- Sangyo—Industrial equipment
- Zyuden—Electric equipment
- Renesas Electronics—Automotive Controllers
- Merck's Onahama paint factory—Specialty Paint
- Other Auto parts—Generic parts Supplier
Supply Chain Disruptions—Tsunami 2011

• Alternative Sources
  • China
  • Philippines

• Restoration of Power Supply

• Design sharing and alternative IT based manufacturing

• Full recovery in about 3 months
Supply Chain Disruptions—Lessons from Tsunami 2011

• Supply Chain Visibility

• Higher Inventory levels

• Second Sourcing (Renesas Electronics was high specialty unit)
  • Increasing the number of lines/ facilities/suppliers

• Design Portability
  • Modular Designs
  • Standardized component parts

• Disaster Prediction and Risk Assessment
Supply Chain Disruptions—Tsunami 2011

• Supply Chain Visibility
  • Most customers have relationship with 1-tier supplier and customers.
  • Customers are generally unaware of how stretched are the supply chains.
  • That is why they are unable of to predict and foresee any troubles within the network.
  • 2017 survey of procurement officers
    • 6% felt that they have complete visibility.
    • This 6% represents full 1-tier supplier visibility only.
• Maintain Inventory to sustain disruption.

• This is a costly alternative, hence hardly any organization is doing it.

• Shorter product lives require large inventories at upstream levels.

Percentage Change in US Inventories
Supply Chain Disruptions—Tsunami 2011

• Second Sourcing
  • Japanese companies learnt that production can be moved from Japan to China to lower cost.

• But it is resulting in concentration of manufacturing in China
  • However if there is disaster (like Covid 19) in China, supply chain can be strained.
Supply Chain Disruptions—Tsunami 2011

• Design Portability
  • Modular Designs
  • Standardized Parts

• Modular Design
  • Boeing Vs. Airbus
    • 737 Max vs A320 neo
    • Boeing faced delays and now crashes of 73 max
    • A320 adopted less complex modular design (as oppose to complex proprietary model)

• If possible and if business allows, use standard parts (specialty non-standard parts are profitable business)
Supply Chain Disruptions—Lessons Status

• Supply Chain Visibility
  • IT infrastructure needs to strengthen

• Inventory levels
  • Cost may prohibit this option

• Second Sourcing
  • Locational diversity is desirable

• Design Portability
  • Managerial level decision, wide acceptability is not possible

• Disaster Prediction and Risk Assessment
  • Forecasting??
Supply Chain Disruptions—Covid 19

• Few risk analyses considered risks on this scale!!

• Crises are quickly forgotten

• Hardly any lesson from 2011 Tsunami is learnt (that is, implemented at large scale), Covid is forcing to re-visit those options.

• Emphasis on sourcing
  • Effective supply chain risk management can identify, analyze, address, and control supply chain risks.

• Better forecast and plan for future crises
Supply Chain Disruptions—Covid 19

• Supply Chain Visibility
  • Investment in IT

• Inventory levels
  • Must be re-visited

• Design Portability
  • Virtual Design networks

• System Approach to mitigate the risk.
• Osotua

  • Masai word meaning resource sharing

  • That is when, there is a disaster you help your competitor to recover
    • Sharing load
    • Helping to rebuild

  • Cooperation in supply chain between competitor