Why companies underprepare for crises – time to stress test supply chains?

Prof. Dr. Mirko Kremer
Covid-19: What’s Supply Chain Got To Do With It?

Products Suddenly Interesting During a Lockdown

Change in online interest in selected products over the past 30 days (as of March 31)

<table>
<thead>
<tr>
<th>Product</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dumbbells</td>
<td>+72%</td>
</tr>
<tr>
<td>Vitamin C gummies</td>
<td>+532%</td>
</tr>
<tr>
<td>Powdered milk</td>
<td>+516%</td>
</tr>
<tr>
<td>Bidet</td>
<td>+374%</td>
</tr>
<tr>
<td>Bread maker</td>
<td>+374%</td>
</tr>
<tr>
<td>External monitor</td>
<td>+160%</td>
</tr>
<tr>
<td>Freeze dried food</td>
<td>+131%</td>
</tr>
<tr>
<td>Mouse for laptop</td>
<td>+85%</td>
</tr>
</tbody>
</table>

Interest is gauged via "hundreds of millions of consumer behavior signals from across the web".
Source: Glimpse

Unexpected Supply-Demand Mismatches...

COVID-19 shortages discussed by healthcare professionals online

Number of ICU beds per day

- Toilet paper
- Masks
- Hand sanitizer
- Water
- Gloves

Source: CREATION
21 Feb 2020 - 12

Models present creations for fashion house Dior Obi during the Milan Fall-Winter collection shows at the Milan Fashion Week
Source: GABRIEL BOUYS/AFP via Getty Images
Exiting a COVID-19 Lockdown: The Bumpy Road Ahead for Many Supply Chains

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Date Written: May 1, 2020
Activities along the Crisis Timeline: Recovery & Preparedness

Covid-19
Survival

Recovery

Covid-20xx
Resilience

Survival

Nach dem Spiel ist immer vor dem Spiel.
(Sepp Herberger)
gutezitate.com
Activities along the Crisis Timeline: Recovery & Preparedness

Assessment
- Assessing Supply Chain risks
- Mapping Supply Chains
- Stress testing

Prevention
- Product Design
- Strategic Sourcing
- Business continuity plan

Mitigation
- Network design
- Facility location & design

Survival & Recovery
- Covid-20xx
- Shorter Duration
- Lower Impact
Wake-up call? Again, really?

Is It Time to Rethink Globalized Supply Chains?

The COVID-19 pandemic should be a wake-up call for managers and prompt them to consider actions that will improve their resilience to future shocks.

Willy Shih  •  March 19, 2020

11 March 2020

IS CORONA A WAKEUP CALL FOR THE SUPPLY CHAIN?

By Prof. Dr. Jan Fransoo

“...However, the real question is whether we should have been better prepared, and whether our current response is a demonstration of incompetence rather than competence. As an academic observer, I am constantly surprised by the lack of risk awareness in the supply chain. In each and every logistics class held in the past 50 years, we have taught students that a dual-sourcing strategy is usually preferable to a single-sourcing strategy if we take all costs into account. Our finance classes stress the need to account for operational risk. However, once they're in the field, many professionals tend to forget the basics they learned in school. Moreover, professionals demand that basic theoretical insights be removed from their programs, because they'd rather learn “tips and tricks” on how to respond to crises. Maybe showing that our profession matters at such moments can be a source of satisfaction...”

Sure.

But this (underprepared supply chains) is likely to happen again. And again. And again.
Myopia: Supply Chain Blind Spots

- Assessment
- Mapping Supply Chains
- Assessing Supply Chain risks
- Stress testing
Find the weak link in your supply chain

Could be you ...

... but could also be here

⇒ Supply Chain Mapping is crucial
Find the weak link in your supply chain

Need smart metrics & SC visibility... to gain crucial insights, such as

Low-cost, commodity suppliers are often overlooked by risk managers.

Myopia: 
(Lack of) learning in “wicked” environments
Strategic sourcing under severe disruption risk: Learning failures and under-diversification bias

**SCRM Return On Investment (ROI)**

- Redundancy
  - Diversify supply
  - Business continuity insurance
  - Backup supply
- Long-term, Disruption ROI
  - Component selection
  - Supplier selection
  - Inventory stockpile

**Note:** For concept illustration only. Axis coordinates depend on firm, industry and nature of disruption.
Strategic sourcing under severe disruption risk: Learning failures and under-diversification bias

Abstract
We study sourcing behavior in “severe” conditions where supply disruptions are rare, but carry the potential of wiping out several periods’ worth of a firm’s profit. The trade-off between scale economies from supplier consolidation and risk mitigation from supplier diversification is at the core of firms’ sourcing strategy, and one that is empirically understudied. We study supplier diversification through a behavioral lens, and test theoretically derived predictions under controlled laboratory conditions. Our data provides strong evidence for “under-diversification.” We posit that this pattern is partly due to the fact that investing in supplier diversification involves an upfront cost to achieve a delayed, and rarely encountered, benefit. Under-diversification bias is costly and its causes difficult to overcome, presenting firms with the daunting task of devising de-biasing mechanisms that reinforce a supplier diversification strategy when the rarity of disruptions almost always render supplier consolidation the ex-post preferred strategy.

Keywords: Behavioral Operations, Experiments, Supply Chain Management, Risk Management
Vicious management cycle: The case of Toyota

Toyota consolidated their supply base again in the 2000s, gaining “unprecedented economies of scale by using single suppliers for entire ranges of its cars across multiple markets”
Supply Base Diversification under Disruption Risk: Fundamental tradeoff

Demand: 100 units
Supply Base Diversification under Disruption Risk: Fundamental tradeoff

Demand: 100 units

Order: 100 units

Fixed cost: 50 €
Supply Base Diversification under Disruption Risk: Fundamental tradeoff

Demand: 100 units

Order: 100 units
Fixed cost: 50 €
Disruption probability: $p$
Supply Base Diversification under Disruption Risk: Fundamental tradeoff

Demand: 100 units
Order: 100 units
Fixed cost: 50 €

Disruption probability: p

Total cost of lost demand

Units not delivered (i.e., lost demand)

0 €  5,000 €  10,000 €
0  10  20  30  40  50  60  70  80  90  100

0 €  5,000 €  10,000 €
Supply Base Diversification under Disruption Risk: Fundamental tradeoff

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Fixed cost: 50 €
Disruption probability: $p$

Demand: 100 units

Cost of lost demand: 10,000 €

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Total cost of lost demand

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Order: 50 units
**Fixed cost: 50 €**
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Supply Base Diversification under Disruption Risk: Fundamental tradeoff

Order: 50 units
Fixed cost: 50 €
Disruption probability: p

Demand: 100 units

Cost of lost demand: 2,500 €

Units not delivered (i.e., lost demand)

Total cost of lost demand

0 €
5,000 €
10,000 €

0 10 20 30 40 50 60 70 80 90 100
High impact low probability disruption risk environments: Main Hypothesis

Decisions “by description”

\[ C(n) = \delta n + \left( \frac{\alpha D^2}{n} \right) [p + (n-1)p^2] \]

Decisions “by experience”

Learning failure & Underdiversification bias

- **Single source**
  - 50 € 50 € 50 € 50 € 50 € 50 € 50 € 50 € 50 € 50 € 50 € 10,050 €
  - receives reinforcement (almost) always

- **Dual source**
  - 100 € 100 € 100 € 100 € 100 € 100 € 100 € 100 € 100 € 100 € 100 € 2,600 €
  - is a waste (almost) always, in hindsight
Results from a controlled experiment

Under diversification bias & Efficient learning coincide

Low probability drives under-diversification bias
How to build sustainable resilience into supply chains?

**Stress Tests & Smart Metrics**

Flexible resources/systems/technologies that add value even in normal times

**Educate. Use Science. Teach Risk. Teach Leaders.**

**We Need a Stress Test for Critical Supply Chains**

by David Smith-Lan and Edwin Smith-Lan

April 06, 2020

**Crisis Management**

Probable need for some regulation towards it.

(As organizational incentives & human decision bias)

Redundancy

- Component selection
- Supplier selection
- Backup supply
- Inventory stockpile

Long-term, Disruption ROI

- Diversify supply
- Business continuity insurance

Short-term, Business as usual ROI

**We’ll keep trying!!**

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