“Normal” Supply Chain Disruptions

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Some supply chain disruptions result from truly abnormal events...
Hurricane Katrina
But most supply chain disruptions are “normal.”

- They are the natural consequence of technological choices that have been made
Such “normal” supply chain disruptions are very costly

- A study of 827 disruptions announced by publicly traded firms from 1989-2000:
  - Average negative effect on stock price ~ 40%
  - Negative effects persist for several years
  - Cause doesn’t matter
  - Findings hold across industries

Source: Hendricks and Singhal, Production and Operations Management Journal, Spring, 2005
Normal disruptions are likely when the supply chain exhibits high levels of

- Interactive complexity
- Tight coupling

### Complex vs. Linear Systems

<table>
<thead>
<tr>
<th>Complex Systems</th>
<th>Linear Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tight spacing of equip</td>
<td>Spread out equipment</td>
</tr>
<tr>
<td>Linked prod. steps</td>
<td>Segregated prod. steps</td>
</tr>
<tr>
<td>Personnel specialized</td>
<td>Little specialization</td>
</tr>
<tr>
<td>Feedback loops not familiar or intended</td>
<td>Few unintended feedback loops</td>
</tr>
<tr>
<td>Limited understanding of some processes</td>
<td>Extensive understanding of all processes</td>
</tr>
</tbody>
</table>
## Tight vs. Loose Coupling

<table>
<thead>
<tr>
<th><strong>Tight Coupling</strong></th>
<th><strong>Loose Coupling</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Delays in processing not possible</td>
<td>Delays in processing possible</td>
</tr>
<tr>
<td>Invariant sequences</td>
<td>Order can be changed</td>
</tr>
<tr>
<td>Little slack available</td>
<td>Slack resources available</td>
</tr>
<tr>
<td>All buffers are deliberate, designed-in</td>
<td>Buffers, redundancies available freely</td>
</tr>
<tr>
<td>Substitutions limited and by design</td>
<td>Substitutions freely available</td>
</tr>
</tbody>
</table>
Interactions

Linear

Tight

Some continuous processing, e.g. drugs, bread

Assembly Line

Most Manufacturing

Complex

Nuclear Plant

Chemical Plants

Mining

R&D Firms

Coupling

Loose
Countermeasures for Disruption Risk

- Simplicity (Lean)
- Flexibility
- Redundancy
Examining the DNA of Lean

- All work is highly specified as to content, sequence, timing and outcome.
- Every customer-supplier connection must be direct, and there must be an unambiguous yes-or-no way to send requests and receive responses.
- The pathway for every product and service must be simple and direct.
- Any improvement must be made in accordance with the scientific method, under the guidance of a teacher, at the lowest possible level in the organization.
Lean and Simplicity

**SYSTEM**

**PATHWAY:**

**CONNECTION**

“Shipping” or other point of customer contact

External suppliers

**ACTIVITY:** Task being done by the person to whom it is assigned

External customers
Following work standards allows process problems to be flagged and corrected before problems are propagated.
Flexibility

- Helps to cope with uncertainty BUT you must specify the nature of the uncertainty!
- Consider two types of flexibility:
  - Range: switching between products and volumes (changing mix)
  - Mobility: new products, new features (volatile market)
**Redundancy**

**Duplication**: two units perform the same function.

**Overlap**: two units have an area of function in common.
Consider a range of choices
# Disruption Countermeasure Summary

<table>
<thead>
<tr>
<th></th>
<th>Pluses</th>
<th>Minuses</th>
</tr>
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</table>
| Lean - Continuous Improvement | Gets at a root cause – complexity  
Learning = Responsiveness | Big organizational commitment required |
| Flexibility       | Fast response                                    | Adds complexity  
“With respect to what” caveat |
| Redundancy        | Seamless response                                | Expensive  
Adds complexity |
Concluding suggestions

- Simplify first
- A portfolio of countermeasures should be considered
- The market generally demands tighter coupling but not necessarily complexity
- Be as specific as possible about the nature of disruption risks before deciding on the countermeasure