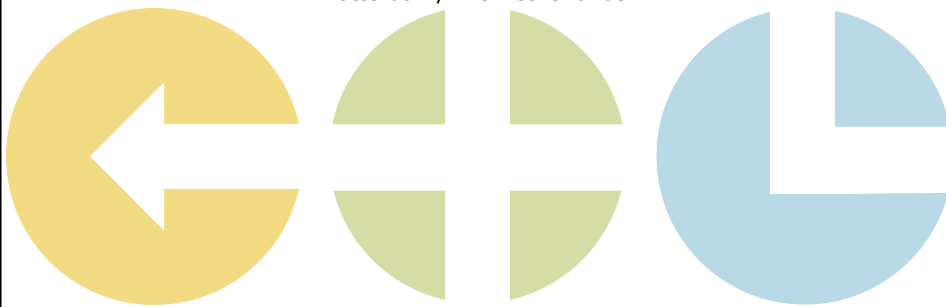


MIT Center for Transportation & Logistics*Supply Chain Risk Management*

Shell Chemicals Best-in-Class SC1x
November 16-17, 2016
Rotterdam, The Netherlands

**Agenda**

- Managing Uncertainty... → Dealing with Disruptions
- Disruptions → Managing Risks
- Managing Risk → Resilience and Prevention
- Key Resilience Success Factors
- Adding Resilience to Supply Chains....

The “Bullwhip Effect” & Managing Uncertainty

STRUCTURAL PROBLEMS:

- Information lags
- Delivery lags
- Independent forecasting
- Order batching
- Price fluctuations
- Inconsistent incentives
- Gaming allocations
- Promotions/discounting

➔

SOLUTION STRATEGIES:

- Reduce Uncertainty
- Reduce Variability
- Reduce Lead time
- Improve Channel Mgt
- Align policies, incentives, KPIs

3

But daily variation is different than disruption

- Avian Bird Flu Outbreak (US), April 2015
- GE Appliance Whse Fire, April 2015
- West Coast US Port Congestion & Labor Action, 2014-2015
- Typhoon Halong, SE Asia, Aug 2014 (\$10B revenue & 41 week impact)
- Severe flooding, NY USA, 2014 (\$4B revenue & 38 week impact)
- Typhoon Rammsun, SE Asia, July 2014, (\$1.5B rev & 38 week impact)
- Gas explosions, Kaoshing, Taiwan, 2014 (\$900M rev & 26 week impact)
- Hazmat spill, Arizona US, 2014 (\$900M revenue & 10 week impact)

- Building Collapse, Rana Plaza Bangladesh, 2013
- Thai Floods 2013
- Hurricane Sandy 2012
- Europe Financial Crisis 2012
- Thai Floods 2011
- Japan Quake/Tsunami 2011
- Haiti Earthquake 2010
- Gulf Oil Spill 2010
- Iceland Volcano 2010
- Russian Wildfires 2010
- Global Financial Crisis 2008+
- Beijing Olympics Summer 2008

How did these affect your supply chain?

Ref: Source material from "The Japan Disaster: Rebuilding Supply Chains" webinar for Journal of Commerce, by B. Artzen and J. Rice, March 24, 2011; and Resilinc Event Watch Annual Report 2014, March 2015 available at <https://www.resilinc.com/products/eventwatch-2014-annual-report/>

6

High Impact of Supply Chain Failures

- Japan Earthquake/Tsunami/Nuclear Meltdown 2011: \$Bs+
- Philips Fire 2000– Nokia vs Ericsson, Ericsson loses \$400m
- West Coast Lockout 2002, \$~20B economic loss
- Boeing 787 Outsourced SC 2007-8, 2-yr delay, \$2B charges
- Mattel Product Quality Recall, 2007, 50% stock price drop
- Hershey Halloween Miss (IT), 1999, \$150M loss, -30% stock
- Nike IT system failure, \$100M revenue drop, -20% stock
- P&G Folgers (Hurricane Katrina)
- GM (tornado at Oklahoma City)
- Land Rover/UPF Thompson frame supplier bankruptcy
- Toyota (Aisin) brake plant fire 1997
- Toyota defective gas pedals, \$1.2B settlement and equity/share loss
- And many others.....LA/LB port disruption/congestion 2014-2015, Hurricane Rita, London-Madrid-Bombay terrorist attacks, labor actions/strikes, SARS, H1NI, HiN5, Somali pirates....



7

7



Effect of Supply Chain Problems

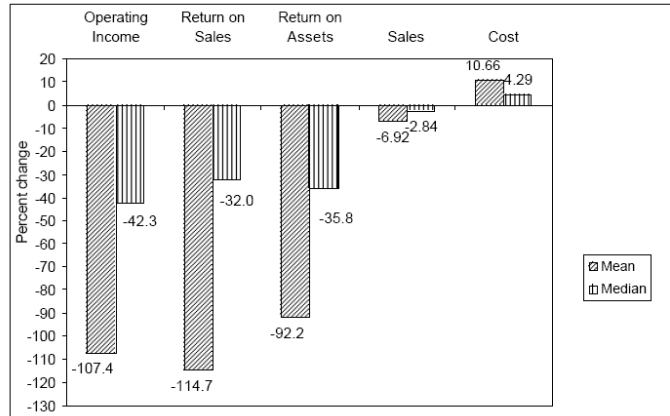
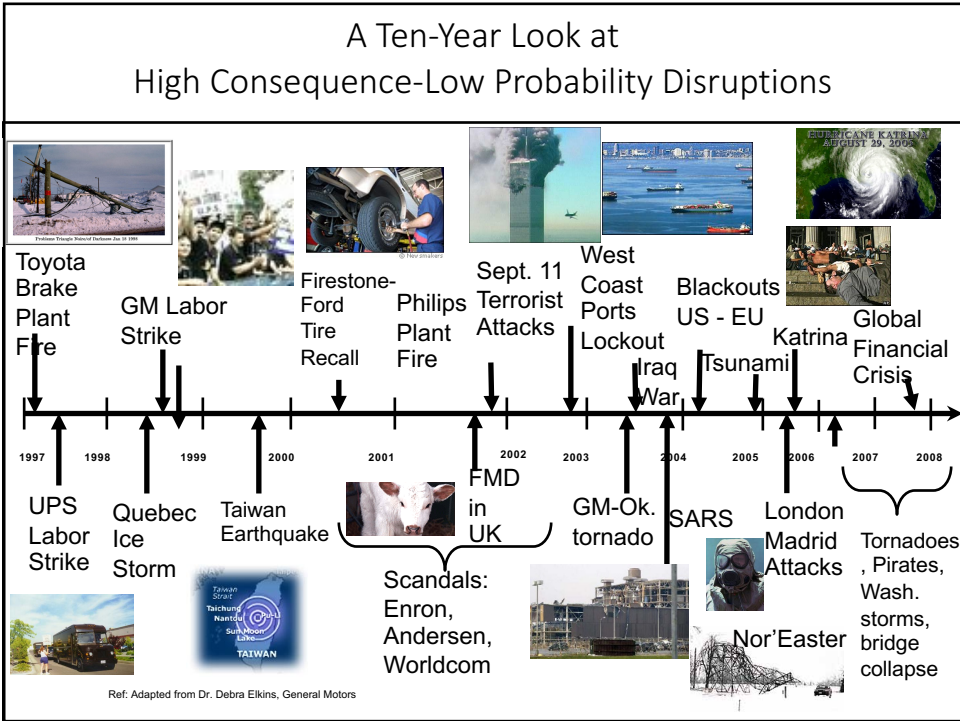


Figure 3: Change in control-adjusted operating performance of sample firms during the year before the announcement of glitches using the most-matched control sample.

Adapted from Y. Sheffi, June '10 MIT Executive Education Program

Source: Hendricks & Singhal, "Association Between Supply Chain Glitches and Operating Performance"



Supply Chain Risk Management

Supply Chain Risk Management

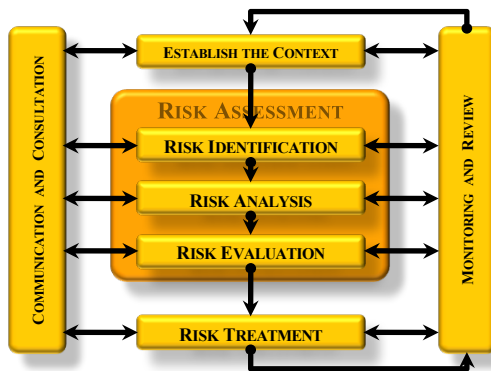
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Supply Chain Risk Leadership Council (SCRLC)



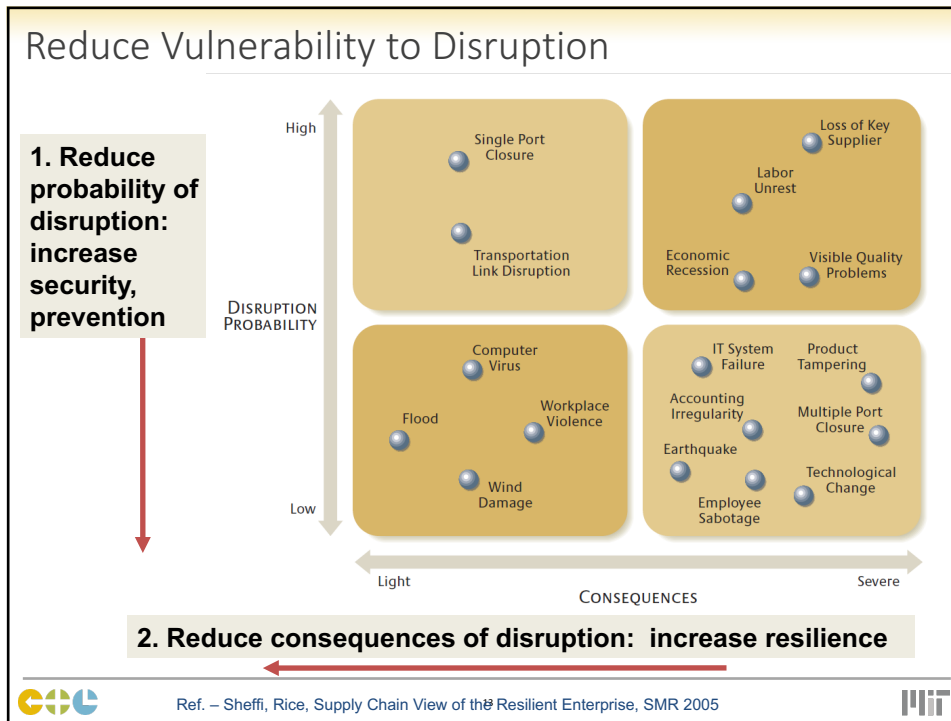
Risk Management Framework & ISO 31000

ISO 31000:2009
RISK MANAGEMENT – PRINCIPLES AND GUIDELINES



- 1. Vulnerability assessment
- 2. Ongoing Monitoring & Measurement
- 3. Crisis Management & Emergency Response
- 4. Mitigation planning & implementation (resilience)





Actions

- Identify options for reducing probabilities & consequences
 - Identify company risk profile
 - Choose right mix of each for the business
 - Prevention or Response? How much of each?
- Reduce Probability → Security and Prevention
- Reduce Consequences → Response and Resilience

Supply Chain Resilience

- In material science, resilience is the physical property of a material that can return to its original shape or position after a deformation that does not exceed its elastic limit.
- Today, resilience is widely used to characterize an organization's ability to react to a disruption (e.g. one caused by a natural disaster) and restore normal operations.
- It's the ability to recreate supply chain capabilities, to 'bounce back' from variations and disruptions*
- "We define resilience as 'the ability of a system to return to its original state or move to a new, more desirable state after being disturbed'."
- How has your supply chain been resilient? Or not?



*Source: "Building a Secure and Resilient Supply Network" by J. Rice, F. Caniato, SCMR Sept-Oct 2003

** Source: Christopher, Peck, at https://dspace.lib.cranfield.ac.uk/bitstream/1826/2666/3/Building_the_resilient_supply_chain-2003.pdf



Design for Flexibility and Redundancy

- Flexibility: prior investments in capabilities & options
 - Workforce trained to perform multiple tasks
 - Products designed to be easily reconfigured based on material and supplier selection
 - Production assets designed to be reconfigured to accommodate variability in demand
 - Provides benefit dealing with daily variations
- Redundancy: prior investments in assets
 - Inventory maintained throughout the supply chain, at suppliers, internally, finished goods inventory
 - Additional production capacity maintained beyond needs to serve known customer needs
 - Only provides benefit when assets are used



16



Key Success Factors

- Failure Mode Analysis (Outcomes) – fail smartly



Sources: "SC Response Project Interim Report" by J. Rice, F. Caniato, Aug 8, 2003; Draft of SC Response Book project, Oct. 2004



Supply Chain Failure Modes / Outcomes

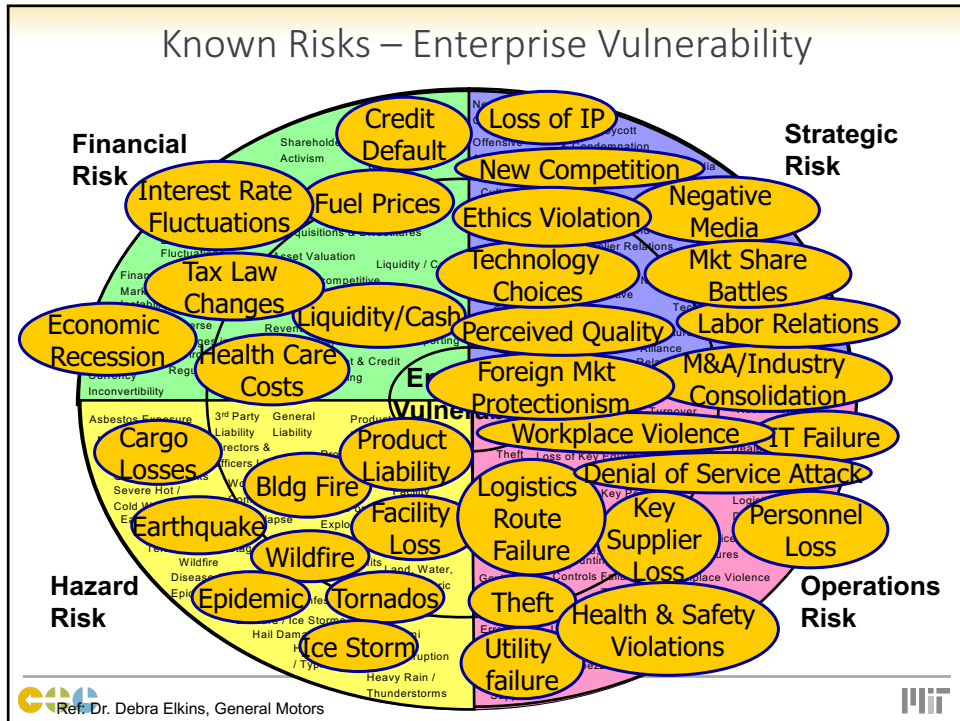
All disruptions result in a loss of one or more of these capacities:

- Capacity to acquire materials (supply)
- Capacity to ship/transport
- Capacity to communicate
- Capacity to convert (internal operations)
- Human resources (personnel)
- Financial flows



18





Key Success Factors

- Failure Mode Analysis (Outcomes) – fail smartly
- Business Continuity Planning – system design, plan to reconstitute
- Response planning – develop response playbooks, CERT teams
- Risk assessment – Impact analysis, maturity assessment
- Many paths to flexibility
- Making the resilience investment: Quantifying Resilience
 - Cost to mitigate, cost to recover, value-at-risk, effectiveness of recovery options, probability of disruption



Sources: "SC Response Project Interim Report" by J. Rice, F. Caniato, Aug 8, 2003; Draft of SC Response Book project, Oct. 2004



Many Paths to Flexibility

- Interchangeability
 - Use standardized facilities, parts, processes
 - Intel, Lucent/Alcatel, Southwest, Helix, UPS
- Postponement
 - Delay customization of product
 - Benetton, H-P, Sherwin-Williams
- Supply
 - Structure contract & relationships with suppliers for response
 - Jabil, Lucent, Toyota
- Distribution
 - Use distribution system for downstream options
 - Caterpillar, Dell
- Flexibility culture
 - Educate for risk awareness, tradeoffs, train for response
 - Nokia, Intel



21



A few examples of flexibility....

- Auto part supplier: Fire burned facilities, data
 - [Standard production process](#), [suppliers](#) provide 'lost' info
- Cantor Fitzgerald: Lost traders, customer info
 - Recaptured 50% of trades using CRM for info
- Intel
 - [Interchangeable plants](#) via "Copy Exact!", Earthquakes BCP
- UPS
 - [Standardized processes](#) enable work force flexibility
- Lucent Technologies
 - [Interchangeable parts](#), standard models, [concurrent SC](#)
- Reebok
 - [Postpone](#) customization of NFL jerseys
- Helix Technology
 - Simplified production so supplier produces in emergency
- Jabil Circuits
 - Builds flexibility into standard contracts, 100% in 4 weeks



22



A few examples of using redundancy....

- Morgan Stanley
 - Redundant IT system, restarted 9-12-01
 - Redundancy added after '93 attack on World Trade Center

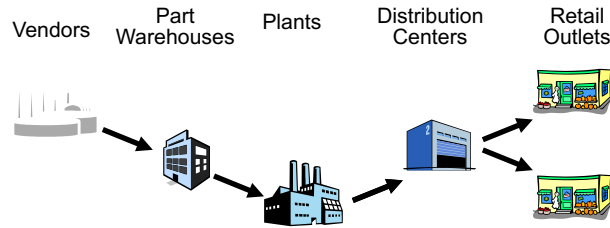
- USPS: Anthrax
 - Used excess capacity to shift processing to other sites

- Boston Scientific
 - Financial analysis indicated cash flow crunch
 - Set up redundant production facility, staff – ready & waiting

- US Government & J&J
 - Maintain stock of medical supplies, rolling inventory

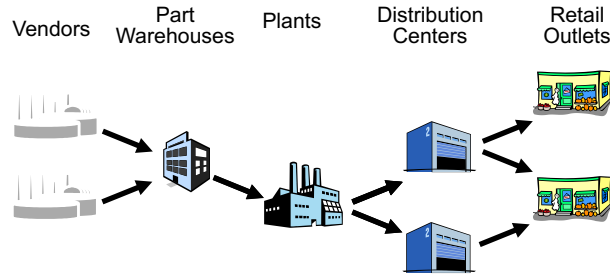


Adding Resilience to a Supply Chain



How would you add resilience to this supply chain?

Adding Resilience to a Supply Chain



Options include.....

- Redesign entire SC for resilience (streamline)
- Adding back up supplier
- Adding additional inventory
- Add additional facility
- Choices on response time
- Buying options for additional capacity in your network....

Break