



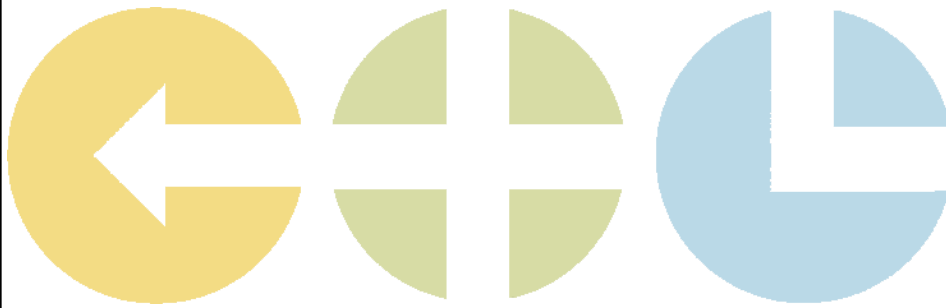
MIT Center for Transportation & Logistics

Supply Chain Risk Management – Resilience

Supply Chains Driving Strategic Advantage

June 14, 2017

Cambridge, MA



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

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SOLUTION STRATEGIES:

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

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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/>

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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....



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Effect of Supply Chain Problems

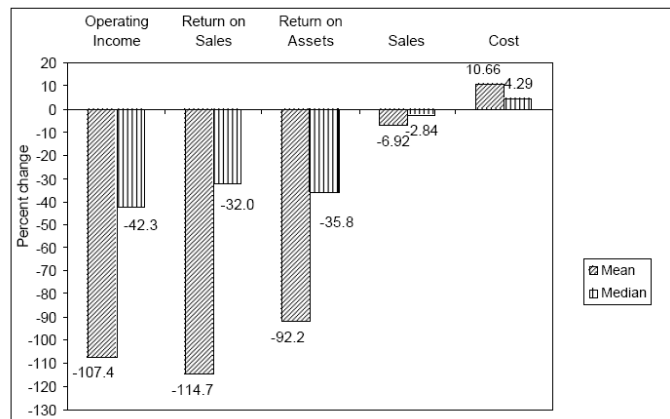
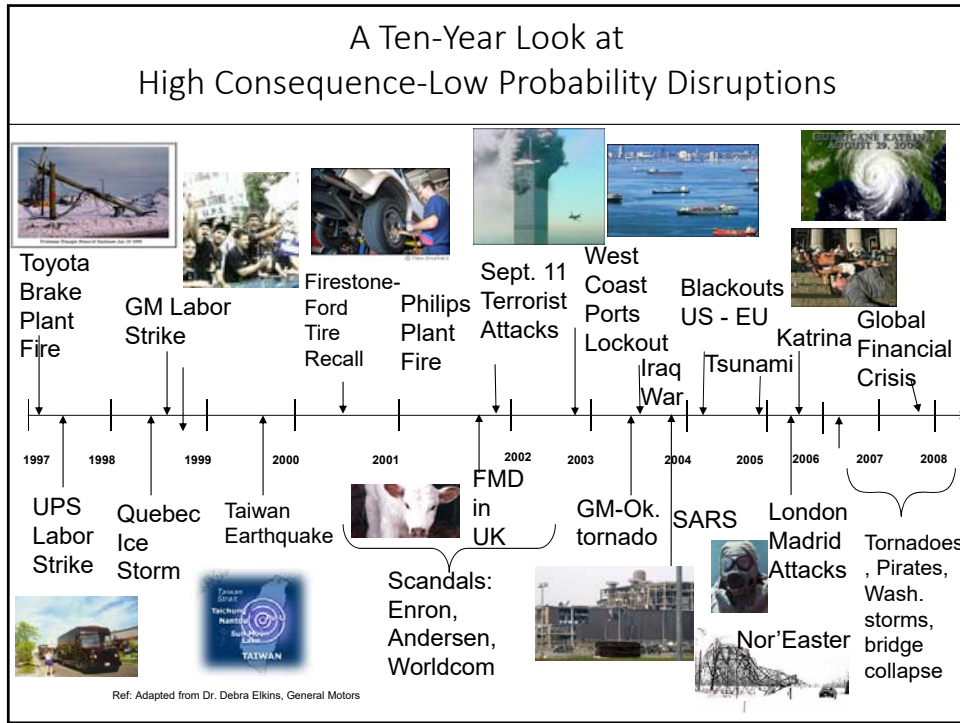


Figure 3: Change in control-adjusted operating performance of sample firms during the year before the announcement of glitches using the most-matched control sample.

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


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Supply Chain Risk Leadership Council (SCRLC)

SCRLC
SUPPLY CHAIN RISK LEADERSHIP COUNCIL

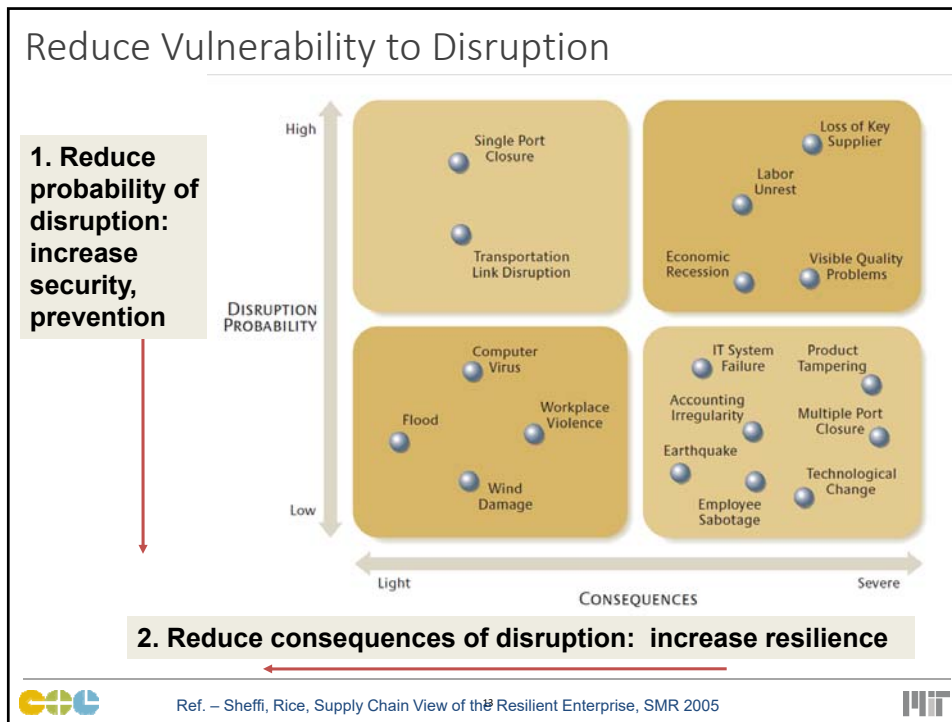
An industry council comprised of world class supply chain firms working together to develop and share supply chain risk management standards and best practices

www.scrlic.com

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/1828/2666/3/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



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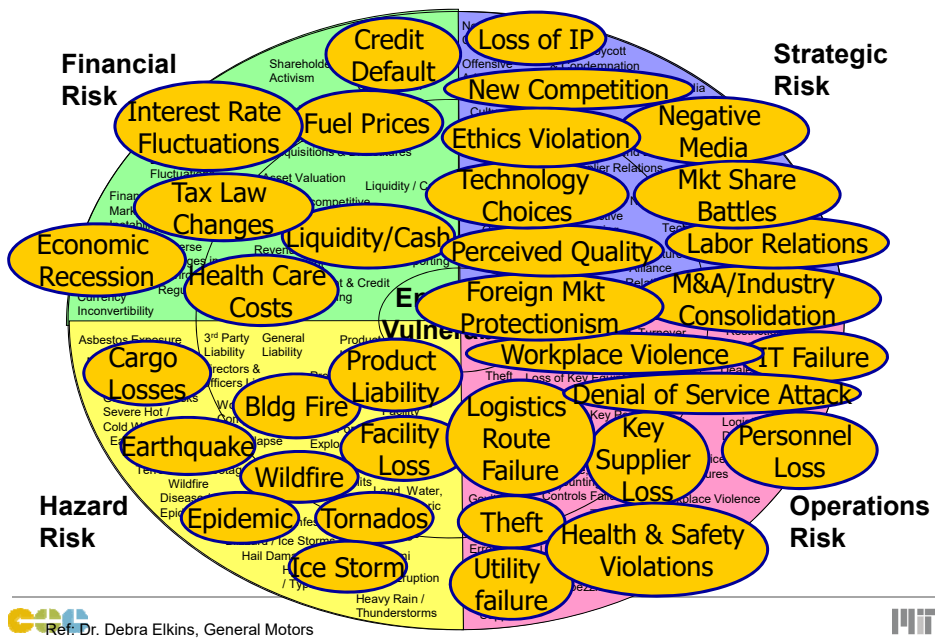
Supply Chain Failure Modes / Outcomes

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



Known Risks – Enterprise Vulnerability



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



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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



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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



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Resilience Through Managing Uncertainty

Uncertainty Reduction

- Risk Pooling
 - Aggregation
 - Platform strategy, product modularization
 - Standardization
 - Inventory centralization
- Time compression
 - Cycle time reduction
 - Postponement
- Information Management:
 - Focus groups, expert opinions IT tools (ERP, cloud, SaaS)
 - CPFR, VMI
 - Demand shaping
 - POS data

Risk Management

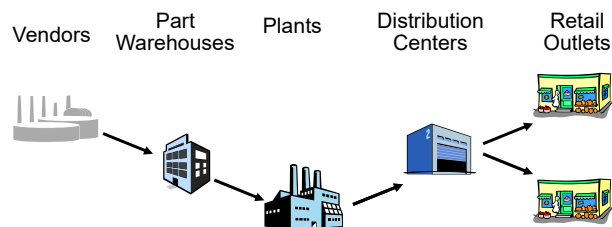
- Buffering
 - Inventory, capacity, time
- Capacity Segmentation
 - 80/20 rule,
 - ABC classification, customer profiles
- Diversify supply sources
- Flexible capacity
- Service level management
- Supply Contracts
- Outsourcing



Ref.: "Supply Chain Principle # 2; Topic: Uncertainty" MIT Supply Chain 2020 Working Paper, M. Singh July 24, 2006

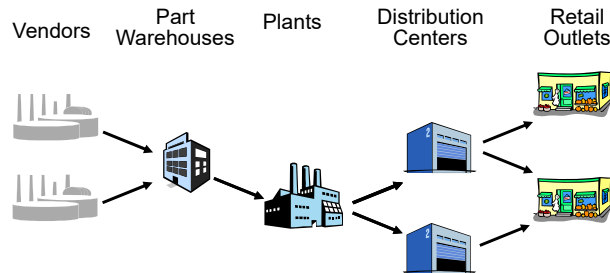


Adding Resilience to a Supply Chain



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