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International Crisis Hits the Supply Chain: The Japan Disaster

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Agenda

- Foundation on Supply chain risk management → resilience
- Review of earthquake/tsunami disaster impact
- Learnings and suggestions going forward

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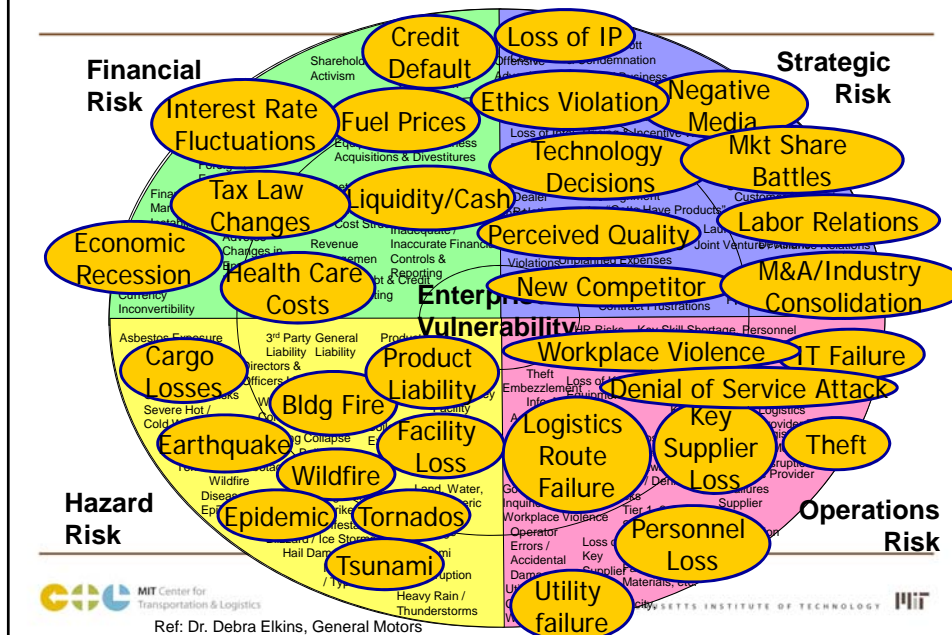
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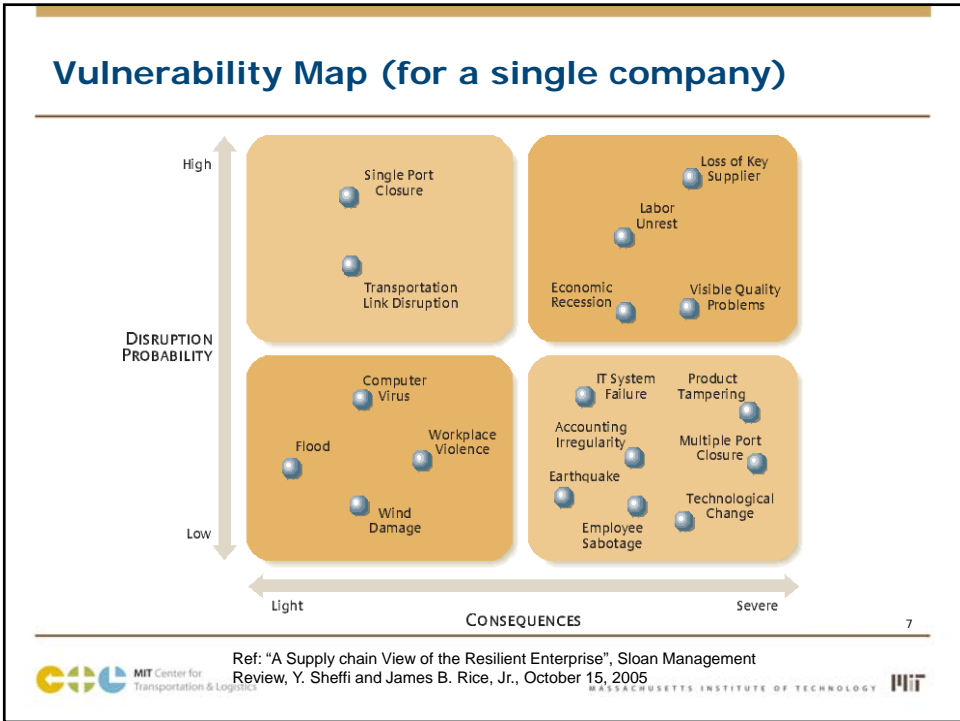
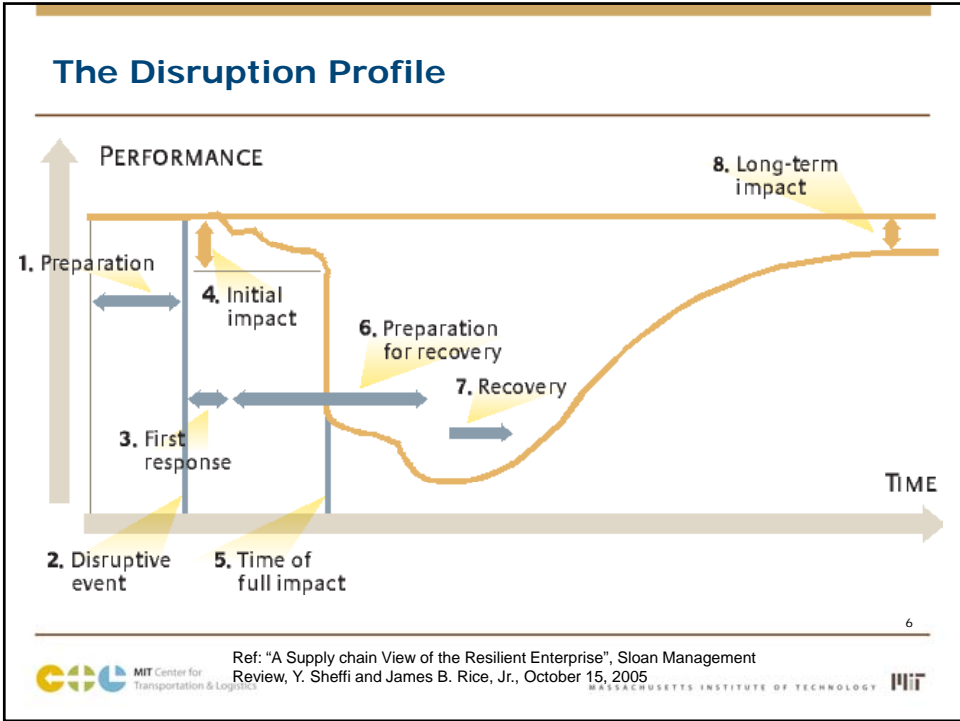
Foundation of SC Risk Management → Resilience

- Supply chains today – global, complex, vulnerable
- High Consequence-Low Probability disruptions have quantifiable business impact
 - They are frequent enough that they are not low probability
- Enterprise vulnerability: strategic, financial, operational, hazard
- Disruption Profile
- Vulnerability Map for a single company
- SC Resilience Principles: assess vulnerabilities and mitigate, reduce probabilities, then focus on failure mode prep
 - FMs – supply, transp, personnel, financial, internal ops, comms
- Fail smartly – flexibility and redundancy
- Many pathways to flexibility

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Enterprise Vulnerability





SC Resilience Principles

- ❑ Business Continuity Planning (BCP)
 - Design to 'fail smartly' – the system WILL fail; plan to fail so that the damage is not crippling
 - "Options" thinking and planning
- ❑ Failure Mode Analysis
 - Focus on recovery from Failure Mode, not risk type/source
- ❑ Design for Supply Network Resilience
 - Ability of system to sustain and recreate itself after disruption
 - Achieve through Flexibility and Redundancy
- ❑ Flexibility
 - Responding through actions that entail prior investments in infrastructure and capabilities
- ❑ Redundancy
 - Responding through actions that entail prior investments in capital and capacity **that may not be used**

Supply Chain Failure Modes/Core Capacities

All disruptions result in one or more of these capacity losses for a period of time:

- Capacity to acquire materials (supply)
- Capacity to ship/transport
- Capacity to communicate
- Capacity to convert (internal operations)
- Availability of human resources (personnel)
- Financial flows (e.g. demand)

Many Pathways to Flexibility

- Flexibility through interchangeability
 - Standard facilities (Intel, GM)
 - Standard parts (Dell, Lucent SCN, Southwest Airlines)
 - Standard processes (Helix, UPS)
- Flexibility through postponement (Benetton, H-P)
- Flexibility through supply (Jabil, Lucent, Toyota)
- Flexibility through distribution (Caterpillar, Dell)
- Flexibility through flexible culture
 - Awareness of risks, tradeoffs
 - Early warning systems (Nokia)
 - Educate for awareness
 - Train for response (Intel)
 - Distributed decision-making (P&G, UPS)
 - Open and unconstrained communication (Dell)



Sources: "SC Response Project Interim Report" by J. Rice, F. Caniato, Aug 8, 2003; Draft of SC Response Book project, Oct. 2004, later pub as "The Resilient Enterprise" by Y. Sheffi

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Considering the Japan quake and tsunami...

- Do these principles still hold?
- What is new?
- What can we learn from the Japan case?

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Considering the Japan quake and tsunami...

- Do these principles still hold?
 - Yes!
- What is new?
 - Awareness of supplier hub vulnerabilities
 - Dependence on niche suppliers in distant tiers
 - Triple disruption – quake, tsunami, nuclear plant failure but ONE OUTCOME – loss of capacity
 - Multiple disruptions are not new – Katrina and levee break
 - Scope is the same (global), scale of impact is greater
 - This really wasn't different than any other disruption aside from the number of companies affected
- What can we learn from the Japan case?

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First lets recap – What happened?

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What happened: company response?

- Emergency Response Centers (ERC) activated & Business Continuity Plans (BCP) exercised
 - “Broken field running”
 - GM – 100s join response tm, 80 visit suppliers in Japan
 - Industry groups collaborate: SCRLC
 - Daily adjustments depending on facility, supply, utility avail
 - Moving operations outside of affected area
 - Resupply from non-traditional sources
 - Allocating inventory to high-margin products until resupply
 - Working with suppliers: resources & collaboration to restart
- Those without ERCs and BCP searching for back-up
 - Searching after a disruption is not the best time to be setting up back-up options

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What happened: business impacts?

- Primary impacts – local ops damaged, personnel lost, comms lost
 - Automotive finished vehicles & parts (esp. engine air flow sensors & engines): Honda, Toyota, Nissan, Mazda
 - High tech: semiconductors, technology (e.g. LCD, silicon wafers, rechargeable batteries, DRAM, NAND, digital cameras): Sony, Hitachi, Shin-Etsu, SUMCO, Toshiba, Nikon, Fujitsu
 - Pharmaceuticals (insulin, penicillin): Novo Nordisk, GSK, Roche
- Secondary impacts – downstream customers suffered loss of supply from primary impacts causing shutdowns
 - Retailers and downstream customers working off inventories, slowdowns
 - Factories in Japan shuttered to conserve power
 - Unreliable utilities (power, water) continue to impact operations
- Discovery of critical dependence
 - Niche suppliers in lower tiers (Hitachi engine airflow sensors, Renesas drive train microprocessors, Mitsubishi Gas BT resin)

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Business Impacts: Capacity Losses

Company	Product	Initial Impact Expected
Apple	iPad 2	Key component suppliers shutdown (NAND flash memory, touch screens, iPad batteries).... Part shortages, cut sales forecasts, constrained supply; struggling to meet orders; "mother of all backlogs" (but from quake?)
GM	Autos	US plant closed because lack of supply of engine air flow sensors
Hitachi	Airflow sensor	Plant damaged; makes 60% of global supply of airflow sensors
Honda	Autos, parts	Dependent on 10 suppliers in radiation zone; Closed component & assembly plants; expect to lose 16,500 units; lost contact with 44 of 113 suppliers Global output down 52%
Mazda	Autos, parts	Plants closed, some to be closed until April
Nikon	SLR cameras	Plant closed; only plant making SLR cameras
Nissan	Autos, engines	Facility closed; lack water, electricity & gas to operate. May send engines from Tennessee plant to Japan... Expect to return to 100% capacity by October. Global output down 22%
Renesas	Drive train microcontroller	Facility closed; lost 40% capacity.... Expects to return to 100% capacity by October, restart in June, using 3P foundries TSMC
Shin-Etsu Chemical	Silicon wafers	World's largest maker of silicon wafers disrupted; 57% of world's wafers come from Japan
Toyota	Autos	Shutdowns across all TMC plants. Original est loss of 140,000 units; 50-70% capacity by June, 500 part shortages.... Now expect 100% by Nov & 90% in Japan in June (up from 70% 2 wks ago). Lost 900,000 units thru May. Global output down 47%

Tier 3 & 4 suppliers put Apple (& others) at risk

Company	Apple	FoxConn (Hon Hai)	ASE or SPIL	Kinsus or Unimicron	Electrotechno (Mitsubishi Gas Chemical sub)
Product	iPad2	Assemble product	Chips (TSMC) to substrate, to PCB	Use BT to make IC substrate	Manufacture bismaleimide triazine BT resin
Location	Retail	China	Taiwan	Taiwan	Fukushima, Japan

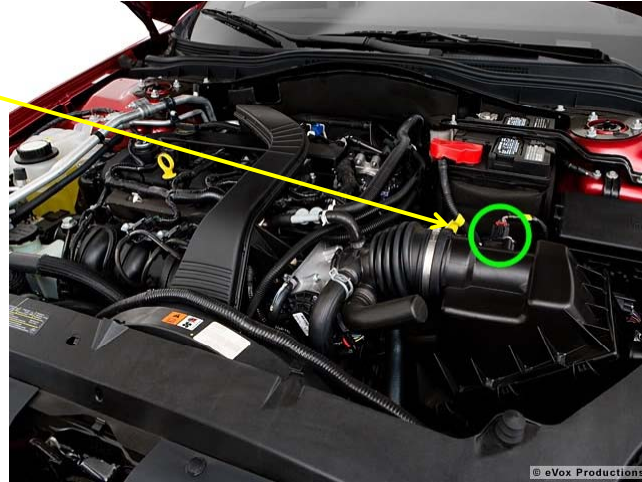
Company	Apple	FoxConn (Hon Hai)	Apple Japan	Kureha
Product	iPad2	Assemble product	Battery cells	PVDF polymer resin
Location	Retail	China	Japan	Iwaki, Japan

- Electrotechno in Fukushima produces ~50% of global BT resin supply
- Kureha in Iwaki makes 70% of global supply of PVDF

Hitachi airflow sensor in Mazda D23



\$2 sensor
in \$90
airflow unit



Tier 1-2-3 suppliers put GM (& others) at risk

Company	GM	GM Engine Plant	Hitachi Automotive Syst	Hitachi
Product	Trucks & Cars	Engines	Mass airflow sensor units	Sensor
Location	Shreveport LA	Buffalo, NY	Sawa/Ibaraki, Japan	Japan

Company	Auto OEMS	Various	Renesas Electronics
Product	Trucks & Cars	Drive train	Microcontroller chip
Location	Global assembly	Various	Naka/Ibaraki, Japan

- Hitachi airflow sensors affecting Nissan, PSA, Ford, VW, Renault, GM. Hitachi makes 60% of global supply of airflow sensors
- Renesas is world's largest maker of microcontrollers, 30% share

Some current thinking

- Outages due to electricity shortages expected
- Many local companies expect impact on earnings thru 3-4Q
- Toyota shifting ratio of overseas vehicle assembly
- Criticism of geo supply concentration, JIT
- Got lucky: 1Q is slow period & chip mfrs build inventory, had 80+ DOI (9 days more than 1Q 2010), added 2-4 wk buffer
- Moody's – Japan earthquake and tsunami have little impact on companies outside Japan
- Two other more vulnerable geos
 - Pearl River Delta in China – conc electr systems & parts mfrs
 - Taiwan – semiconductors
- Suggestion – portfolio SC, risk is spread across geos, technologies, suppliers

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What will happen?

- Still some unanticipated disruptions in the coming weeks/months in downstream supply chains
 - Not limited to automotive & high tech industries
- Japan is not the world's leading supplier
 - Japan is 8th largest supplier.... Imagine if this occurred in China?
- Expect some costs to increase (electricity)
- Growth opportunities
 - For those firms that fill the void left by lost capacity
- Resilience and risk management will matter to many
 - But only for a little while; only a subset will take action
 - Will your company act now to prepare for the next disruption?
- Wisdom of JIT & Lean practices are being challenged
 - But the advantages are so high and downsides can be mitigated
- Soft earnings & growth will be blamed on Japan, true or not

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What should companies do?

- Seize the moment: get senior exec support for risk mgt action
- Develop back-up plans
 - 'Business continuity plans' (BCP) focused on restoring lost capacities
 - Failure mode focus (the limited set of core capacities)
- Identify full supply chain network (Tier 1, 2, 3, etc.) & risks
 - Who are my suppliers?
 - Assess geographical risk (Are my suppliers all located in the same geo?)
 - Assess organizational risk (Are we sole sourced?)
 - Assess embedded risk (Are my various suppliers all dependent on a common material source?)
- What are the probabilities & consequences of loss
 - Reduce probability of disruption through preventative measures
 - Reduce consequences through mitigation measures: resilience
 - Choose balanced mix of redundancy & flexibility
- More aggressively manage risk (SCRLC ref)

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Supply Chain Risk Leadership Council

SCRLC
SUPPLY CHAIN RISK LEADERSHIP COUNCIL

What: A council of leading experts representing a broad spectrum of interests that are exposed to diverse types of supply chain risks. Together, SCRLC discusses, brainstorms, and develops a core set of principles and practices to foster advancement in effective management of supply chain risk.

Current Members:

- **Industry:** Cisco, Boeing, GE, Coca Cola, John Deere, FedEx, LMI, Zurich Insurance, Procter & Gamble, Medtronic, Genentech, Applied Materials, Jabil Circuits, Rolls Royce, Foxconn, Merck
- **Government/Think Tank:** TSA, RAND, USAF, ASIS
- **Academia:** University of Michigan, MIT, Stanford

Best Practices Guide



The SCRLC will publish a "Supply Chain Risk Management (SCRM) Best Practices Guide" later in June 2011

- Available online at www.scrhc.com
- A detailed "how to" guide for the SCRM practitioner or novice
- Feedback welcomed; please share with others

Considering the Japan quake and tsunami...

- Do these principles still hold?
 - Yes!
- What is new?
 - Awareness of supplier hub vulnerabilities
 - But this really wasn't different than any other disruption
- What can we learn from the Japan case?
 - Companies proven to be more resilient than expected
 - Assess geo or industry structural vulnerabilities
 - Reduce probability, exposure to those vulnerabilities
 - Failure mode preparation

References & Thank you

- SC Resilience Publications
 - Mechanical Engineering Magazine “Beyond the Breaking Point” article, June 2011
 - Text your email & name to 516.627.7062 for copy
 - Sloan Management Review “A Supply Chain View of the Resilient Enterprise” article
 - <http://sloanreview.mit.edu/the-magazine/2005-fall/47110/a-supply-chain-view-of-the-resilient-enterprise/>
 - Other references
 - http://ctl.mit.edu/research/supply_chain_resilience_publications
- THANK YOU
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