Risks in Global Supply Chains –
Examples and Management Approaches

4th Supply Chain Management Symposium
Dr. Josef Oehmen

Center for Clean Water & Energy at MIT and KFUPM

- Multi-year Collaboration between MIT and KFUPM
- Research in the areas of
  - Clean Water Technologies: desalination, distribution networks, developing world systems
  - Clean Energy Technologies: solar, carbon capture, high sulfur fuel turbines
  - Design Methodologies: technology readiness, innovation, entrepreneurship, risk management
- Educational programs:
  - Development of new courses, undergraduate design curriculum, and entrepreneurship at KFUPM; new graduate subjects at MIT.
- Website: ccwce.mit.edu
Lean Advancement Initiative at MIT

- “Daughter Initiative” of MIT’s International Motor Vehicle Program
- Past focus on Aerospace & Defense Industry
- Today: Enterprise Transformation in large public-private partnerships
  - Management of Defense Acquisition Programs
  - Management of Healthcare Systems
- Website: lean.mit.edu

Risk Management was important 500 years ago...

“Prudent princes [should] regard not only present troubles, but also future ones, for which they must prepare with every energy, because, when foreseen, it is easy to remedy them.”

- Niccolò Machiavelli
  The Prince (1513)
Overview

- Examples of Supply Chain Risks
- Types of Mitigation Actions
- Supply Chain Risk Management Process
- Results of a Risk Management Survey

The Case for Supply Chain Risk Management: Balancing “Lean” for Long-Term Success

Lean Management & Cost Efficiency
- Establish Pull of Work in Progress
- Establish Flow and Takt
- Eliminate Waste
- Define Value & Map Value Stream

Risk Management
- Crisis Management & Continuity
- Essential Buffers & Backup Capacity
- Increased Agility
- Minimization of Uncertainty
Example 1 of a Lean Supply Chain: The UK Food Industry

- Several national disaster scenarios
  - Gemini: Disruption of fuel supplies
  - Long Shadow: Disruption of energy supplies
  - Winter Willow: Infectious Disease

- Critical items
  - Bottled Water
  - Bread
  - Milk
  - Infant Formula

Simple Question:
What happens in the UK Food Supply Chain in case of national disaster?

Results of the Study: Move to Switzerland

- Who runs supermarkets when most of the staff is ill or cannot get to work?
  - The Military! Or maybe the police!
  - No. They don’t have enough people (and probably other problems at the time)

- Who distributes fuel or food when people are fighting for it?
  - See above

- Who prevents people from “buffer buying” when supplies run low?
  - See above

- What happens to food that is “off”, but people are hungry?
  - Surely it can still be sold or given away for free!
  - No. Your company would be closed down.

- When do truck drivers / check-out workers get vaccinated in case of a pandemic?
  - With doctors and nurses, so they can keep working!
  - No. With us and all the other normal people.

- What happens when supermarkets close and trucks are not unloaded?
  - Well, they just take it back to where it came from!
  - No. Cross-docking stations would freeze up almost immediately.

- What happens when power is down and SAP does not run anymore?
  - There surely is a paper-based workaround!
  - Sometimes (if retailer had troubles during their SAP implementation)

Source: adapted from Peck 2007
Example 2: Delivery Risk in the Mobile Phone Industry

- Thunder storm in New Mexico
- Lightning strikes power line
- Power failure
- Emergency power generators fails
- Cooling in one clean room fails
- Fire in one oven
- Sprinklers work, fire fighters alarmed
- Fire was already put out when fire fighters arrive
- Small clean room contaminated
- First production after 3 weeks, 50% capacity after 3 months

Source: Norman & Jansson 2004
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A very small fire at a 2nd-Tier supplier causes...

- Immediate recognition of problem
- Close monitoring (several times a day)
- Deployment of own technicians to supplier, involvement of top management
- Immediate global sourcing activities
- Immediate re-design of components so that other production capacities can be used
- Result: A lot of stress for the crisis management team, but business as usual in production
- Ignoring of problem for weeks (did not want to report bad news to superiors, Philips promised to deliver again next week (every week))
- No close monitoring of the supplier
- When problem was realized, world-wide backup capacities were no longer available
- Result: Loss of several month of mobile phone production (in 2000!), loss of $400m, insurance payment of $200m, and:

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Example 3: Schedule Risk in Innovation Drive-Supply Chains
Boeing 787 Dreamliner

Complex product with a complex supply chain – management of product development across the supply chain very problematic
- 70% of components outsourced
- 50 tier-1 suppliers
- Risk sharing contract: No payment of development cost to supplier until first unit delivered to customer
- Technology risks at tier-1 suppliers (e.g. composite fuselage) undetected
- Management of development and manufacturing at tier-2 suppliers (by tier-1 suppliers) causes delays

Program Start: January 2003
Original Delivery Date: May 2008
Current Delivery Date: 1st Quarter 2011

Impact of Supply Chain Risks
- Up to 30% of Supply Chain costs are risk-related
- Cases of bankruptcy and near-bankruptcy
- 10-11% loss of share price after major Supply Chain disruption
- 100s of millions of dollar disruption cost
- Loss of customers due to quality and availability issues
- Legal and reputational consequences from bribes, fraud, or violation of work / safety / social standards
  - Reputational damage travels upwards in the supply chain to company with the strongest brand or proximity to customer
  - Liability of the company: penalty payments
  - Personal liability: penalty payments, prison

Source: Hendricks & Singhal 2003, 2005a, 2005b; Norman & Janson 2004
What can be done: Risk Mitigation Actions

1. Lean Management & Efficiency
   - Reduce Waste
   - Define Value & Map Value Stream
   - Establish Flow and Takt
   - Establish Pull
   - UK Food, Nokia, Ericsson, Philips, Boeing

2. Reduce internal uncertainty
   - Planning accuracy
   - Process stability & execution
   - Communication & integration
   - UK Food, Nokia, Ericsson, Boeing

3. Reduce external uncertainty
   - Political & Social
   - Nature
   - Crime & sabotage
   - Technology
   - UK Food, Nokia, Ericsson, Philips, Boeing

4. Increase speed and agility
   - Communication & integration
   - Process design emphasizing agility
   - Nokia
   - UK Food, Ericsson, Boeing

5. Create essential buffers
   - Capacity buffer
   - Material buffer
   - Time buffer
   - Cost / liquidity buffer
   - (Boeing)
   - UK Food, Nokia, Ericsson

6. Business continuity planning
   - Insurance
   - Detection
   - Crisis Management
   - Recovery
   - Nokia, (Boeing, Ericsson)
   - UK Food, Ericsson

Example: Reduction of Internal Uncertainty

- Logistics:
  - Optimization of inventory management, forecasting and risk pooling
  - Optimization of transportation logistics: network, transportation, warehousing, distribution strategies
- Contracts:
  - Optimization of contracts: Make to stock, make to order, C-part sourcing, VMI
- IT:
  - Optimization of IT and information integration: Real-time data sharing, SC-wide key performance indicators, collaborative forecasting, minimizing the bullwhip effect
- Supply Chain Coordination:
  - Integration of the supply chain: Push/pull break, lead time optimization and JIT, strategic alliances, 3PL
  - Production strategies: Make-or-buy, insourcing and outsourcing, local vs. global sourcing
Example: Increase Agility – LAI Enterprise Transformation Cycle

Context: Enterprise Risk Management and the ISO 31000

- A generic risk management process framework is defined by the new ISO 31000 standard
- It consists of three main parts:
  I. The „classic“ risk management processes
  II. The „integration loop“ with risk management processes in other departments (or on other levels)
  III. A monitoring and review loop
Supply Chain Risk Management Process

Risk Identification
- Delimitation of risk identification
- Description & visualization of supply chain
- Identification of risks
- Summary in risk catalogue

Risk analysis & evaluation
- Qualitative risk analysis
- Evaluation of probability of occurrence
- Evaluation of business impact
- Visualization in risk portfolio

Risk Mitigation
- Identification of risk mitigation actions
- Evaluation of mitigation actions
- Decision & implementation
- Monitoring & Review of actions

Source: Ziegenbein 2007, Oehmen 2010

Supply Chain Risk Assessment in 1 Minute – Please count the number of “yes” answers –

- Do you know who your critical suppliers are and how much their failure would impact your company’s profits?
- Have you fully mapped your critical supply chains upstream to the raw material level and downstream to the customer level?
- Have you integrated risk management processes into your supply chain management approaches?
- Do you have routine timely systems for measuring the financial stability of critical suppliers?
- Do you understand your tier 1 production facilities and logistic hub exposures to natural catastrophes?
- Is supply chain risk management integrated into your enterprise risk management approach?
- Do you record the details of supply chain incidents and the actions you have put in place to avoid future incidents?
- Do your tier 1 suppliers have business continuity plans that have been tested in terms of their viability?
- Have you provided risk training to your supply chain management team?
- Is risk on the agenda at performance meetings with your strategic suppliers?

Scoring Results:
8-10: You probably have a good understanding and control over the risks you face
5-7: You may have a number of key gaps which could impact your reputation or profitability
3-4: How are you sleeping at night?
0-2: Good luck

Source: Wildgoose / Zurich Insurance, 2010
Goal of Supply Chain Risk Management: Smart Resource Allocation

1. Focusing management attention where it is needed
   - Risk-driven SCM

2. Making sound entrepreneurial choices
   - Optimized Risk-Return Portfolio
   - Stability and Long-term Success

3. Ensuring the survival of the company in rough times
   - Crisis Management and Business Continuity Planning

Risk =
Effect of Uncertainty on Objectives

Risk Effects:
Supply Chain Objectives
- Low Cost (operational and investment)
- High product quality (e.g. reliability)
- High process quality (e.g. on-time delivery, availability)
- Excellent reputation (e.g. preferred SC partner)
- Safety & Security conformance (e.g. health & environment)

Risk Causes:
Sources of Supply Chain Uncertainty
- Own Company (e.g. people, process, technology)
- Supply chain partners (e.g. customers, suppliers)
- External environment (e.g. politics, society, nature, macro-economy, technology)
MIT Survey of Supply Chain Risk Management

- Conducted by Dr. Bruce C. Arntzen
- MIT Center for Transportation & Logistics
  - Engages over 60 faculty and research staff from all 5 MIT schools
  - Works with over 50 companies across the world
  - SC2020: High-performance supply chains
  - Security, resilience and risk management in supply chains
  - Sustainable and low-carbon supply chains
  - And much, much more: ctl.mit.edu

Top Internal Risks: Product Quality, Raw Material Price and Supplier Failure

<table>
<thead>
<tr>
<th>Frequency of Internal Risks</th>
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<tbody>
<tr>
<td>Product Quality Failure</td>
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<tr>
<td>Spike in raw material costs</td>
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<tr>
<td>Raw Material supplier failure</td>
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<tr>
<td>Transportation carrier failure</td>
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<tr>
<td>Finished Goods manufacturing failure</td>
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<tr>
<td>Inventory write-off due to new design...</td>
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<td>Cash crisis due to customers delaying...</td>
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<tr>
<td>Spike in energy costs</td>
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<tr>
<td>Employee theft and executive misdeeds</td>
</tr>
<tr>
<td>Cash crisis due to sudden drop in credit...</td>
</tr>
</tbody>
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Source: Arntzen 2010
Top External Risks: Recession, loss of electricity, currency fluctuations

Frequency of External Risks

- Economic Recession or Market Collapse
- Extended Loss of Electricity (>1 day)
- Sudden Currency Devaluation
- Protracted Labor Disputes
- Computer Virus or Cyber Attack
- Product Tampering or Counterfeit Products
- Spike in energy costs
- Floods or Mudslides
- Disease or Infestation
- Civil Unrest or Terrorism
- Earthquakes or Tsunamis

Source: Arntzen 2010

Narrow View of Big Disasters

Importance Rating of Supply Chain Risks

- Raw Material supplier failure
- Product Quality Failure
- Finished Goods manufacturing failure
- Spike in raw material costs
- Transportation carrier failure
- Economic Recession or Market Collapse
- Inventory write-off due to new design change
- Failure of major software systems
- Cash crisis due to customers delaying payment
- Spike in energy costs
- Sales collapse due to a new competing product
- Price collapse due to a new competitor
- Protracted Labor Disputes
- Cash crisis due to sudden drop in credit rating
- Sudden Currency Devaluation
- Extended Loss of Electricity (>1 day)
- Fires or Explosions

Interpretation:

- Perception of “Point” impacts of large risks, not “Network” impacts.
- This results in low associated loss of Transportation or Communications with large-scale disasters.
- Also, Corporation-wide Business Continuity Planning is a strategic action and above the “pay grade” of many supply chain professionals.

Source: Arntzen 2010
Company Size has Strong Influence on Supply Chain Risk Management Practices

SC Risk Management Practices

Have a SCR manager  Have a BC manager  Have a BCP  Works with suppliers  Works with customers

| SCR = Supply Chain Risk | BC = Business Continuity | BCP = Business Continuity Plan |

Source: Arntzen 2010

Example: Siemens SIRA Method

Source: www.siemens.com
Example: Return-on-Risk (RoR) Risk Management Suite


- Risks in Global Sourcing
- Strategic Collaboration & Cooperative Networks
- Performance-based Logistics
- Maritime Supply Chains
- Natural Gas & Energy Supply Chains
- IT for Risk Mitigation
- Managing Project Risks

Other books by the ISCRIM Network:
- Brindley 2004: Supply Chain Risk (Ashgate)
Summary

• Supply Chain Risks are real and expensive
• Risk Management = Long-term balancing of cost savings and resilience
• Supply Chain Risk Mitigation = Supply Chain Process Improvement (not only buffers)
• Supply Chain Management is more than just logistics: Value-Creation in the extended Enterprise
• Focus your attention on largest uncertainties, balancing risk and return, and business continuity planning