Supply Chain Vulnerability in Times of Disaster
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By Gerhard Plenert, Mohanish Makharia & Ramanan Sambukumar

In an increasingly globalized competitive world where margins are under constant pressure, supply chain optimization is critical. Much of the focus in designing supply chains in the last decade has been on the optimal use of resources, offshoring to cheaper locations, outsourcing non-value add activities, institutionalizing just-in-time systems and investing in communication technology.

While these new business paradigms have resulted in more efficient and responsive systems, the supply chain risk profile has been altered significantly. Many companies have been left vulnerable due to anemic risk mitigation systems, and these systems have yielded to major variations in demand or supply caused by unforeseeable events, both natural and man-made. Caught unaware by such disruptions, these companies have suffered losses of revenue, market share and consumer trust, and in some cases have even faced bankruptcy.

Supply Chain Disruptions Can Be Painful

In last year’s Japan earthquake, tsunami and nuclear crisis, Toyota’s operations were affected to the extent that it took over six months before complete recovery was possible. The delay in the launch of two models caused an estimated production loss of over 140,000 vehicles, the company’s profits fell by over 30% and it lost its position as the largest automaker in the world.

Of course, not all supply chain disruptions are caused by natural disasters. Cisco rode the technology wave in the 1990’s to become the market leader in the network component business, but it had no experience in managing downturns. When the tech bubble burst and demand slowed significantly, the company did not have the capability to track the inventory of products across its geographically-spread supply system. Their systems were designed for high responsiveness, which meant high inventory buffers. Lack of inventory tracking capability resulted in high inventory accumulation which in a bust market led to the eventual write-down of $2.2 billion in 2001 alone.

Broadly defined, a supply chain disruption is an unusual spike or steep fall in either demand or supply leading to a huge imbalance between the two. According to Jossi Sheffi, director of the MIT Center for Transportation and Logistics, “The essence of most disruptions is a reduction in capacity and hence inability to meet demand.” Companies cannot afford to treat supply chain disasters as ‘black swan’ events that have a negligible chance of happening.

Recent studies suggest that less than 25 percent of Fortune 500 companies are prepared to handle a supply chain crisis and that a $50 million to $100 million cost impact can be incurred for
each day a company’s supply chain network is disrupted. (Alpaslan, April 2003) As part of a research study on supply chain risk and its impact on equity volatility, Prof. Vinod Singhal and Kevin Hendricks concluded that it could take two years or more for companies to recover from a major supply chain failure. (Hendricks, 2003)

What is a Resilient Supply Chain?

As illustrated in Exhibit 1, disruptions happen for various reasons and the nature of their impact also varies. For example, a labor union problem can be anticipated whereas a terrorist attack is unforeseeable. Also, the time taken for the impact to be felt differs and is unique to each disruption and to each company. For instance, a fire in a factory can potentially halt operations immediately, whereas the outbreak of an epidemic in a supply zone could have a more subtle impact and will take more time to set in. Companies with a resilient supply chain will be able to anticipate these events better than their peers, and will be able to delay and minimize the impact of the disruption by taking proactive risk-mitigating steps.

Following the September 11, 2001 tragedy, U.S. flags, lapel pins and other patriotic objects became extremely popular, but consumers had a difficult time finding them in major retailers like Kmart and Target. That’s because Wal-Mart, using its real-time demand tracking and analysis system, responded swiftly to the situation by locking up all the supply resources they could find.

Wal-Mart is not the only retailer that knows how to benefit from external supply chain disruptions. Zara, a Spanish clothing retailer, had black clothes on its shelves immediately after the 9/11 events. While the normal lead-time in the garment

Exhibit 1: Categorizing Supply Chain Disruptions

Bubble size indicates potential impact of disruption. The model is generic in nature, companies may experience different impacts due to these disruptions based on their risk exposure.
business is 90 days, Zara was agile enough to assess a market need and respond within five days.

Why do some companies do better than others in times of disruption? The answer lies in their ability to detect the disruption and swiftly act on it. While these events cannot be predicted with precise accuracy, their major impacts can be narrowed down to one of five areas:

1) Supply failure
2) Manufacturing operations failure
3) Logistics failure
4) Information and technology failure
5) Workforce unavailability

While companies focus on efficiency and responsiveness in traditional “business-as-usual” environments, they should be flexible enough to quickly switch their operation scenarios to adjust for disruptions. A scenario-based strategy for disaster proofing with the focus on impacts of disruptions will not only minimize damage to the bottom line but can potentially help score over debilitated competitors. This is illustrated in Exhibit 2:

In Exhibit 2, company B has institutionalized a Business Continuity Plan (BCP) and invested in visibility systems for early detection of disruptions, whereas company A has not. When a disruption occurs at point T, Company B is able to discover it at point B1 and recover from the disruption rapidly, minimizing the impact of the disruption. Company A detects the disruption only at point A1 and takes a longer time for recovery.

Philips was a major supplier of semiconductors to Nokia and Ericsson in 2000 when a fire at a chip plant in Albuquerque destroyed chips for millions of cell phones. When Nokia learned about the incident, they immediately set up a troubleshooting team to assess the full impact of the incident and find alternatives. They rapidly sourced three of the five affected chips from within their existing supplier network with a five-day lead
time. A senior management team from Nokia worked out a deal with Philips to use the latter’s capacities in other plants for sourcing the remaining two parts. With these efforts, Nokia was able to make all customer shipments in time.

In contrast, Ericsson took several weeks to respond to the situation, and by that time most of the market capacity had already been allocated to Nokia. The impact was devastating for Ericsson, which took a $2.34 billion loss in its mobile phone division, citing not only component shortages, but a poor product mix and marketing failures.

Preparing for Supply Chain Disruptions

As shown in Exhibit 2, risk mitigation efforts can be classified in three phases:

1) **Proactive steps taken before the disruption occurred.** Building a resilient supply chain, addressing all identified disruption impacts, and investing in early warning systems

2) **Reactive steps taken when the disruption has occurred and been detected.** Acting with agility to expedite recovery

3) **Post-recovery steps.** Performance reporting, reevaluating the supply chain, and recovering losses through insurance claims

While the strategic vision must take a top-down trajectory, the operational activities need to be implemented from the bottom-up. Based on the efforts required before, during and after the disruption, Exhibit 3 presents a comprehensive framework to build a resilient supply chain:

**Exhibit 3: Framework for building a Resilient Supply Chain**

<table>
<thead>
<tr>
<th>Proactive: Plan for Disruption</th>
<th>Reactive: Minimize Damage</th>
<th>Feedback and Damage Control</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STRATEGIC</strong></td>
<td><strong>OPERATIONAL</strong></td>
<td></td>
</tr>
<tr>
<td>Before disruption</td>
<td>During the disruption</td>
<td>Post the disruption</td>
</tr>
</tbody>
</table>

- **Proactive: Plan for Disruption**
  - Conduct enterprise level supply chain risk assessment
  - Make risk adjustments to total cost of sourcing equations
  - Design actionable BCP covering all failure scenarios
  - Identify authorities for decision making during disruptions
  - Invest in improving capacity and inventory visibility

- **Reactive: Minimize Damage**
  - Paradigm shift with less emphasis on efficiency and more on business continuity
  - Sanction supplies from reliable alternative sources, employ alternate transport nodes and manufacturing facilities in case the preferred options fail. Risks associated with the alternate sources should be divorced from those borne by primary solutions
  - Diagnose all the impacts to the supply chain once a disruption has been identified
  - Invoke the BCP to ensure safety of employees and continuity of operations
  - Take swift action to employ available capacities within the organization and supplier network
  - Constantly monitor the situation

- **Feedback and Damage Control**
  - Reevaluation of the supply chain to assess the following parameters:
    - Effectiveness of BCP
    - Effectiveness of early disruption detection systems
    - Validity of Total Cost of Ownership / Sourcing equations
    - Resilience of the supply chain to future disruptions
  - Prepare a disruption report that covers failure points as a result of disruption, cause and effect analysis, comparative analysis of disruption performance vis-a-vis industry peers
  - Last line of defense: Insurance Cover
  - Systematic loss reporting to mitigate losses through insurance cover
Proactive Steps: Plan for Disruption

Strategic Actions
Anticipate Disruption with a Business Continuity Plan
• Assess the vulnerability of your company to supplier and manufacturing operations failures, logistics failures, workforce unavailability and information and technology disruptions. Build "what-if" scenarios for all such events and assess your current capacity to respond.

• Engineer a crisp actionable contingency plan for failure of any supply chain pillars. Identify key thresholds for executing risk-mitigating decisions like sourcing from alternate partners, channels, or alternate manufacturing and distribution systems whose risks are divorced from the preferred options.

• Most disaster situations lead to chaos due to the non-alignment of multiple departments within the same company. That makes centralized decision-making based on real-time information from all sources crucial. Institutionalize a contingency management team that will champion all actions during times of disruption. This team must be comprised of senior people who can exercise influence over the various decision levers of the company.

Invest in Required Technology
• Invest in information systems that improve real-time visibility of used and spare capacities and inventory in the entire system, including that of the suppliers.

• Institutionalize your supply chain intelligence systems including exception event planning systems designed to discover events that cross the threshold of normal operating parameters.

• Employ the power of social media for early detection of disruptions. Dell, which is known for its pioneering supply chain work, is now using social media to interact with its customers with the objective of being able to improve reaction time and be more responsive to market needs.

Build Resilience through Flexibility
• Standardize components as much as possible to derive aggregation benefits and reduce overall inventory and engineering costs.

• In a volatile market, attempt to postpone the customization of products until after receiving the customer order.

• Identify next best alternatives as back-ups for the most vulnerable supply chain nodes.

Sourcing Decisions
• Supply Chain decisions, predominantly sourcing, should not be made on the basis of traditional costing models, but rather on the Total Cost of Sourcing equations that are adjusted for the expected value of supply chain risk.

Operational Actions
Test Your Business Continuity Plan
• Conduct regular mock drills for likely disruption scenarios to evaluate the company’s readiness for such events.

Prioritize Critical Components and Supply Chain Nodes
• Segment inventory in levels of criticality based on unit cost, sourcing and manufacturing options, and lead time to re-stock. Maintain progressively higher buffer levels for critical segments.

Assess and Monitor Supplier Risk Profile
• Screen critical suppliers based on their risk scores and mandate the selected ones to institutionalize a realistic
BCP. Test the relevance and dependability of your suppliers' BCP.

- Conduct regular meetings or teleconferences with key suppliers to get their opinion and feedback on potential disruptions.

Monitor Your Supply Chain Intelligence

- Constantly monitor each country/region for threats and trends that will affect your supply chain – including weather, port and transportation strikes, fuel prices, currency exchange, inflation, labor rates, pending legislation (i.e., trade sanctions, quotas, anti-dumping duties, Free Trade Programs), political elections that may alter the country's view of trade and natural disasters.

- Constantly monitor the supply chain for 'exception' events and assess their potential impact.

- Monitor the supplier quality (defect rate, timely order fulfillment), raw material price variations and market demand) to detect major variations from planned levels.

- Employ historical data for operations planning. Avoid certain regions in certain times. For example, Florida ports are subject to hurricanes from June to November. Perishables or other time-sensitive goods may need to exclude South Florida ports from their distribution networks through these months.

Reactive Steps – Minimizing the Damage

Strategic Actions

When a disruption has been detected, a rapid paradigm shift from a efficiency maximizing scenario to one based on maintaining business continuity is critical. Senior management must be involved in the decision-making process to reinforce the paradigm shift in these times. The BCP needs to be invoked and risk mitigation strategies need to operationalized. Once the impacts of the disruption have been assessed, customer commitments must be revaluated in the new demand-supply scenario. Swift decision making during times of disaster will empower a company to minimize the impact on service levels and thereby minimize the effect on market share.

Operational Actions

- Take actions in accordance with the BCP to ensure the safety of employees and continuity of operations.

- The contingency management team must assess the potential impact of the identified disruption on the company’s supply chain and take mitigating actions as per the BCP. For example, in case of a critical supplier failure, evaluate the affected components and the current available capacity within the entire network. In case the requirements cannot be met with the existing facilities and contracts, sanction procurement from alternate supplier base that is not faced with the same risks as that of the primary source.

- Evaluate the cost-to-serve to different customers and markets in the new demand-supply scenario and, if required, re-segment the market to calculate profitability equations based on the order fulfillment capability in times of disruption.

Post-Recovery: Controlling the Damage

Strategic Actions

Supply chain disruptions will expose any company’s weaknesses and are a test-bed for the organization’s resilience. While such disruptions may cause extreme financial damage, companies must conduct a post-mortem exercise to draw learnings from the experience. They must reassess the efficacy
of the BCP, the disruption detection systems, and their supply chain risks.

**Operational Actions**
- Prepare a disruption report that captures failure points as a result of disruption, a cause and effect analysis, and a comparative analysis of disruption performance when compared to industry peers.
- Employ social media to collect feedback on the disruption mitigation actions for future course correction.
- Last line of defense: Coordinate with the insurance provider to recover the covered losses directly attributable to the disaster.

**The Business Imperative**

The frequency and severity of supply chain disruptions has increased tremendously in the past two decades of globalization. While investing in supply chain risk management comes at a cost, it is offset by reduced insurance premiums. Besides, companies that have taken steps to mitigate the adverse impacts of a disruption have been able to contain their damages and in some cases have learned to benefit from them. A resilient, flexible, scenario-based supply chain provides a competitive edge during times of major disruptions and is not a choice – instead, it is a business imperative for "best in class" companies.

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**Bibliography**


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