Applying Best Supply Chain Practices to Humanitarian Relief

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ABSTRACT

With the growth in length and breadth of extended supply chains, more companies are employing risk management techniques and resilience planning to deal with burgeoning and costly supply chain disruptions. As companies can learn from humanitarian groups, so can humanitarian groups learn from industry how to respond, recover, and prepare for these disruptive events. This paper looks at industry leaders in supply chain risk management and explores how humanitarian supply chains can learn from industry best practices.

Keywords

Supply chains, disruption, resilience, risk, mitigation

INTRODUCTION

A common goal for traditional operations and supply chain managers is to design processes that operate efficiently in a stable or steady-state environment. The behavior of a system over time is predicted, monitored, and controlled; variance is minimized and stability prized. A stable environment, however, is only temporal, especially in today's fast-paced world of interconnected producers and consumers (Kotter, 2014). Disruptions occur and systems must adjust to those disruptions to meet the needs of their constituents and continue to operate. Moreover, the pace and severity of those disruptions are accelerating. For example, the percent of companies reporting a supply chain disruption increased from 28% in 2011 to 42% in 2013 (Saenz & Revilla, 2014). Damage from natural disasters are accelerating as well. In 2005, Hurricane Katrina caused $81.2 billion in damages; in 2011, the Japanese earthquake and tsunami cost $235 billion. Industry cost from closed manufacturing plants in Japan reverberated throughout the supply chain causing shortages and higher prices for months and years after. (Park et al. 2013).

Supply chain disruptions are typically classified as internal or external to a firm, or as demand-related, supply-related, operational or strategic (Manuj & Mentzer, 2008). Thus, under one taxonomy, supplier unreliability would be categorized as external to the firm; and in the other, as supply-related. These normal expected disruptions may include sudden swings in demand; changing business or financial cycles; new products, markets, technologies or competitors; scarcities of materials, labor or other resources; regulatory changes, trade policy shifts, new laws or governments; unreliable or unethical suppliers or managers; labor unrest, quality and environmental problems; and poor strategic choices, rash decision making, or risky behavior. While at times challenging, these turbulent and complex day-to-day supply chain disruptions can usually be handled via appropriate management responses and established risk management techniques.

It is the unusual, catastrophic, low probability/high impact disruptions that are more difficult to predict, and for which firms are unprepared to plan, react, or ameliorate. Examples include pandemics, natural disasters, acts of terrorism, cyber-attacks or armed conflicts, the very domain of disaster recovery and humanitarian aid groups. Van Wassenhove (1996) suggests that industry has much to learn from the field of disaster recovery and humanitarian supply chains, and similarly, that humanitarian supply chains could benefit from the experiences of industry. With growth in the length and breadth of extended supply chains, more companies are employing risk management techniques and resilience planning to deal with burgeoning and costly supply chain disruptions. This paper looks at industry leaders in supply chain risk management and explores how best practices can be shared.

THE RISK OF SUPPLY CHAIN DISRUPTIONS

An interconnected world brings new types of risks. This is especially true of global supply chains. As the supply chain lengthens and extends geographically, more work is pushed down from buyer to supplier to subcontractor to several more layers of suppliers and sub-contractors. Risk and exposure to disruption in this extended supply chain are magnified, making it more difficult to control the effect of the disruption. Most companies start with the idea of controlling risk; that is, identifying risk factors, quantifying them, prioritizing and seeking to reduce or eliminate them. While it is certainly important to be risk-aware in making decisions, it quickly becomes apparent that all risk cannot be eliminated and some risks (from global outsourcing, for instance) are worth the exposure. Companies (like communities) are moving toward building resilience into their systems so that when disruptions occur, the impact is less severe and recovery occurs more quickly.

According to the World Economic Forum (WEF), supply chains are the backbone of the global economy. Robust and resilient supply chains are critical to public health, safety and security worldwide. In a recent report, the WEF recommends establishing an internationally agreed upon risk assessment process, international standards for supply chain resilience, incentive-based programs for compliance, and data-sharing platforms for risk identification and response (Bhatia, et. al. 2013). Clearly, keeping the flow of supply open in the face of disruption is of global importance.

There are several companies that excel in supply chain resilience. Dell builds redundancy into its supply chain, offers substitute product configurations, tailors supply chains to customers, and operates four global command centers for predicting, monitoring and recovering from disruptions (in Texas, Ireland, China and Malaysia). Kimberley Clark uses extensive demand sensing and demand shaping algorithms to increase service levels while reducing inventory. Proctor & Gamble and Unilever use supply chain segmentation, extended supply chain visibility, and virtual manufacturing networks to flexibly manage disruptions. Intel has reduced lead times, implemented supplier and materials certifications, and increased the monitoring of both suppliers and consumers. Samsung's supply chain design incorporates risk (in product R&D) and involves multi-tiered suppliers in its sales and operations plans (S&OP). Cisco, a global information and communications technology firm, won the Institute of Supply Management's Award for Excellence in Supply Management with its submission on supply chain risk management (O'Connor 2012). We describe Cisco's supply chain risk management resiliency initiatives in more detail in the next section.

SUPPLY CHAIN RISK MANAGEMENT AT CISCO

Cisco's initiative to embed resiliency in its supply chain began after its experience with Hurricane Katrina. In an attempt to get itself and its customers up and running shortly after the disaster, Cisco distributed $1 billion in telecommunications equipment without visibility into the ultimate destination or cost of the action. Now, Cisco's business continuity planning (BCP) is based on an information system that collects extensive data from over 1000 suppliers in 50 countries, including emergency contacts, supplier capabilities, supplier sources (2^{nd} and 3^{rd} tier), alternative sources of supply, power sources, and time to recover (TTR). The Crisis Management Dashboard (tied to an NC4 external situational awareness feed and Google Earth mashup) monitors events worldwide 24/7, and alerts and dispatches Incident Management Teams within two hours. Crisis Playbooks direct team action. (Miklovic & Witty, 2010)

In terms of resiliency, Cisco first tried a standard incident-based approach, i.e., (prob. of occurrence x potential loss). That proved ineffective when the company focused its efforts on preparing for the 62% San Jose earthquake probability with more corporate losses, and ignored a 30% Japan earthquake probability that would affect suppliers but not Cisco 'directly.' As humanitarian groups have found, it is exceedingly difficult to predict exactly when or where the next disaster will occur. Cisco's second approach to resiliency was product-based. They began by identifying 100 products that were critical to profitability. Without predicting when an incident might occur and where, Cisco (with its supply chain partners) set out to build-in resilience for the critical products. A resilience index was created composed of: (1) component resiliency, (2) supplier resiliency, (3) manufacturing resiliency, and (4) testing resiliency (O'Connor et al, 2012).

The traditional incident based approach *might* evaluate risk as:

(Prob of Typhoon) [Potential loss of revenue + potential cost of recovery].

The index approach would have a score for each factor and a weight of importance, and *might* appear as follows:

Weighted Importance Score of Component = [(% single sourced parts) (# SS parts in BOM) (Weight as % final product revenue)] + [(Avg. TTR for single source) (Weight as % sourcing capacity)] + suppliers w/o BCP + (availability of 2^{nd} source) (% reliability) + ….

The four resiliency indices are added for overall resiliency. Remedies would then be applied to bring the resiliency level up to established thresholds.

After using the index approach in several subsequent disturbances (such as Chengdu earthquake, Icelandic volcano eruption), it became apparent that a 'simulation' of disruptions was in order. For example, while data collected from suppliers identified alternative sources of supply, several suppliers used the same backup supplier, resulting in large backlogs of work and overlong recovery times.

Distributions of demand, recovery times, etc. were added to the model to more realistically estimate response. The location of second-source suppliers in lower risk areas was also added to the model. The model continues to evolve with input from suppliers, customers and managers.   Other lessons from industry follow.

LESSONS FROM INDUSTRY

In addition to industry reports, academic research into company performance and disaster events can yield sage advice. The following table lists several best practices for industry supply chains gleaned from case studies or simulation models of company or industry data, along with examples of their potential application in humanitarian relief.

Supply Chain Best Practice	**Application to Humanitarian Relief**
Provide extra flexibility for complex products or processes. (Craighead et al, 2007; Vilko et al, 2012)	Relief for more complicated processes (such as shelter) should allow for more flexible solutions. Ex. – temp shelter in Haiti; evacuations for Katrina
Determine whether it is more important to have an efficient or resilient supply chain. This can vary by product (Tang, 2006).	Determine which elements should be efficiently supplied (e.g., food, water, medical care) and which ones require more thought and preparation (e.g., not building back in flood zone). Lean vs. Agile. Ex. – Joplin; Haiti; Katrina
Focus on minimizing the duration of disruption, rather than the frequency. (Schmitt & Singh, 2012)	The frequency of disasters is less controllable. Focus on activities that will reduce TTR, e.g., resiliency. Ex. – cybersecurity;
Risk pooling (e.g., centralization of supplies) saves cost when demand is uncertain. Risk diversification better when supply is uncertain. (Bradley, 2014)	Risk pooling ex. – use DR to stage goods. Diversify for critical items - substitution, multiple sourcing, decentralized distribution. Ex. - Sandy
Investing in small amounts of flexibility can have significant payoffs if disruptions occur. (Tang et al, 2008)	Have alternative methods ready for supply and distribution. Ex. – Fix quay, ship by water vs air for Haiti.
The location of buffer inventory is more important than the amount. (Carvalho et. al, 2012)	Determine where aid is needed or can be most readily distributed. Pre-positioning of supply. Identification of critical points.

Supply Chain Best Practice	**Application to Humanitarian Relief**
Both upstream and downstream demand risk should be factored into inventory decisions. (Schmitt & Singh, 2012)	Higher demand during a disaster may mean less supply for ordinary demand. Watch for stockpiling, hoarding, & entitlement. What are decoupling points & timing in filling demand? Ex. - water bottles in Haiti; Ebola treatment centers
Excess capacity can be just as effective as excess inventory. (Park et al., 2013)	Having companies ready to respond with supplies can be better than warehousing contributions. Ex – Florida to Haiti
Portability of designs and other operational data is important. (Park et al., 2013)	Prepare for moving locations or loss of data/resources. How will you set up at another site? What do you need to do so? Essential or NTH?
Risk and resilience need to be constantly monitored. (Christopher et al, 2011)	Build basic levels of resilience (e.g., DFID approach). Monitor trends/events. Revisit preparations. Practice disaster plans.

Table 1. Supply Chain Best Practices

CONCLUSION

Humanitarian supply chains face problems of immediacy with limited resources and compromised infrastructure. Industry supply chains face many types of disruptions, some of them related to disasters and others related to normal business activity. When severe disruptions occur, both types of supply chains share the need to recover quickly (minimize TTR) and to build resilience to that end. Lessons from industry supply chains include gathering data that can be easily accessed when non-standard courses of action are needed, providing flexibility (even in small amounts) redundancy of services and supplies (at the right location), and monitoring and evaluating risk and resilience along many dimensions (infrastructure, economic, community, etc.). It is hoped that this paper will lead to discussions of techniques and philosophies that can be shared between industry and humanitarian relief/disaster recovery groups.

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