MIT SCALE RESEARCH REPORT

The MIT Global Supply Chain and Logistics Excellence (SCALE) Network is an international alliance of leading-edge research and education centers, dedicated to the development and dissemination of global innovation in supply chain and logistics.

The Global SCALE Network allows faculty, researchers, students, and affiliated companies from all six centers around the world to pool their expertise and collaborate on projects that will create supply chain and logistics innovations with global applications.

This reprint is intended to communicate research results of innovative supply chain research completed by faculty, researchers, and students of the Global SCALE Network, thereby contributing to the greater public knowledge about supply chains.

For more information, contact
MIT Global SCALE Network

Postal Address:
Massachusetts Institute of Technology 77
Massachusetts Avenue, Cambridge, MA 02139 (USA)

Location:
Building E40, Room 267
1 Amherst St.

Access:
Tel: +1 617-253-5320
Fax: +1 617-253-4560

Email: *scale@mit.edu*
Website: *scale.mit.edu*

For Full Thesis Version Please Contact:
 Marta Romero
 ZLOG Director
 Zaragoza Logistics Center (ZLC) Edificio
 Náyade 5, C/Bari 55 – PLAZA 50197
 Zaragoza, SPAIN
 Email: mromero@zlc.edu.es
 Telephone: +34 976 077 605

Improving supply chain resilience for a fashion retailer: A qualitative and quantitative study

Authors: Alfonso Robles Guic and Robert Severson

Thesis Advisor: Prof. María Jesús Sáenz, Ph.D.

ABSTRACT

Modern trends in supply chain have led to more efficient operations but have also increased sensitivity to disruptions. Severe impacts of disruptions in recent years have brought increased awareness to this issue and some companies have started to use disruption management thinking. In this paper, a two-pronged approach of quantitative and qualitative analysis is used in order to arrive at the sponsor company's current state of resilience. Then, the data and analysis are used to develop trial contingencies as a foundation for a complete business continuity plan and develop conclusions about future areas of growth in disruption resilience. Out of seven categories identified to describe a company's resilience, four (cost-benefit evaluation, disruption risk perception, recovery plan, and redesign of recovery) were improved through this study.

KEY WORDS: Supply Chain Risk Management, Disruption Management, Resiliency, Business Continuity Management

M.Eng in Logistics and Supply Chain Management, MIT-Zaragoza International Logistics Program

Master of Business Administration, Vlerick Business School

B.S. in Electrical Engineering, Catholic University of Chile

M.Eng in Logistics and Supply Chain Management, MIT-Zaragoza International Logistics Program

B.S. in Business Administration, University of Nebraska-Lincoln

KEY INSIGHTS

1. The qualitative analysis shows us that the category with most room for improvement is the cost-benefit evaluation for disruption management.

2. Through simulation of more than 30 different supply chain disruptions, critical components of the network were identified.

3. Duties and handling costs are key components to consider when selecting an alternative DC to take over a disrupted one.

INTRODUCTION

Supply chain management has been subject to various business trends in the last two decades. Globalization, centralization, and focus on efficiency have led to more vulnerability to different disruptions. During disruptions, the adverse effects of any initiating event may spread quickly through the supply chain, with the efficiency measures leaving little buffer time for the companies to look for alternative solutions to handle the abnormalities (Sheffi, 2005).

The higher risks, uncertainty, and impacts have led many consultants, researchers, and managers to agree on the importance of supply chain resilience. Many companies have addressed the issue by emphasizing preparation for recurrent, high-probability events, but they have also continued the outdated approach of ignoring low-likelihood risks (Chopra & Sodhi, 2004). Zsidisin et al.

(2005) gave an explanation of why this portion is commonly ignored through the "Expected Value Paradox." There are at least two reasons for this: probability of occurrence being used in the analysis together with the expected value approach which assumes linear utility. Zsidisin et al. (2005) suggest that, for catastrophic events, these assumptions are questionable.

In order to account for the large impact disruptions, the thesis uses a resiliency definition that does not attribute any weight to probability. Sheffi's (2005) definition to consider disruption resiliency: "business having the ability to recover quickly." This perspective considers how a firm can handle the major disruptions that can damage it the most; the same disruptions that have been identified to be neglected.

An anecdote literature cites to be a great example of disruption management is about Li and Fung, the famous global sourcing firm that deals extensively in garments. Tang (2006) relates that, when the Indonesian Rupiah devalued by more than 50%, instead of passing the problems on to their customers, Li and Fung shifted a portion of production to other suppliers outside of Indonesia and provided financial assistance to the Indonesian suppliers. These actions kept the supply of goods stable and allowed Li and Fung to fulfill their service obligations to their US customers.

As implied from this literature review, in the area of supply chain resiliency there are a myriad of perspectives, models, frameworks, and concerns. Chopra and Sodhi (2014) identify that reducing risk while improving

performance can be achieved through segmentation, or regionalization, and preferring overinvestment to underinvestment. Tang (2006) gives generalized and prudent advice. A resilience policy should be a robust approach that does not hinder daily operations yet also achieves its purpose of helping sustain operations during a major disruption.

THESIS SCOPE

Recent events, such as the Tohoku earthquake and tsunami of 2011, have led companies to reevaluate their risk management policies. Such a reevaluation has been an ongoing initiative in the sponsor company's supply chain function. As the next step in this process, improvement of the business continuity planning of the sponsor fashion retailer is the main objective of this thesis.

Although, for successfully managing disruptions, both pre-disruption and post-disruption approaches are necessary and need to be taken in consideration, this thesis will mainly approach from the post-disruption view. This is because of the nature of disruptions assessed as well as by request of the sponsor company. Low probability/high impact events need to be addressed mainly through contingency planning, since it is almost impossible to try to prevent their occurrence (Sheffi, 2005).

In order to complete this satisfactorily, the following two research questions were developed to guide the study:

1. What is the current state of resilience of the fashion retailer?

2. How can the fashion retailer improve its supply chain resilience?

These questions set the concerns of the thesis to start at the basic level, from which improvements in key areas would be developed. Thus, in order to answer these questions adequately, this case study considered a multi-methods design: to collect and analyze data and draw inferences using both quantitative and qualitative methods.

METHOD

Conceptual Framework Structure

The basic conceptual structure of the project can be outlined in four steps:

1. Convergence of Evidence

2. Disruption Simulation

3. Scenarios Evaluation

4. Options Thinking

These steps can be related to the section structure: step one can relate to current state analysis, steps two and three relate to the disruption quantifying models. Step four is the guiding principle for developing conclusions and recommendations.

Benchmark Analysis

Benchmarking was primarily done by researching written sources as well as visiting logistics and operational sites of other firms, but it also involved informal discussion with professionals from related industries or related functions in other industries.

Qualitative Evaluation

The qualitative methodology, as an alternative to the survey method, has been used frequently in recent operations management studies. The interviews were structured around an interview protocol designed by the researchers to evaluate the resilience state of the company considering the most important factors according to the literature.

The selection strategy of the participants, both from the European (EU) and Asia-Pacific (APAC) regions was "successive:" the first interviewees were selected intentionally, then, participants were selected so as to complete the information needed.

Data was analyzed using the thematic analysis method, which allows identification and analysis of thematic patterns from the data collected. To control for the validity of the analysis the researchers followed the best practice of doing consistency checks.

Quantitative Evaluation

In an early stage, data requisition yielded the following information for two of the biggest distribution centers within the geographical scope of the project:

- Distribution center (DC) inbound and outbound volumes

- Average inventory by week

- An example of the e-commerce monthly recap

- Inbound lead time by ship mode

- Order fulfillment rate by channel

Restrictions led the research to supplement the data with publicly available information such as financial data and other investor relations press releases and information gathered from the qualitative method.

RESULTS

Description of Industry

The fashion retail industry is a heavily buyer-driven consumer goods industry (Ghemawat & Nueno, 2006). Products characteristically have a short life cycle, a volatile demand cycle, and are subject to impulse purchasing (Cortez, 2012). Despite some significant entry barriers such as brand heritage and economies of scale, there is some risk of entrants due to the possibility of differentiation (Cortez, 2012). There is also a threat of substitute products.

The buyer-driven supply chain is very different from the producer-driven global chains of the automotive and high tech industries. The more fragmented and dispersed upstream structure is a major difference from producer-driven chains as well (Ghemawat & Nueno, 2006). The relatively low cost of transport and the nature of the work required to produce the product make production a commonly off-shored and outsourced activity in low labor cost countries.

These industry factors mean that there are some areas of disruption in which the industry is somewhat more protected against disruption. For instance, with suppliers having high competition, small individual size, and commodity material inputs, suppliers' disruptions do not pose as great a threat to the firm. The industry also finds some areas in which it has advantages in reaction. To

explain, the industry's focus on the demand-side and the customer means it heavily invests in dealing with issues on this end and it is therefore more perceptive and reactive to changing pull factors.

Company Analysis

The company that is the subject of this thesis is a large luxury fashion retailer, founded in the United States, which primarily deals in ready-to-wear. Its premium lifestyle products are sold across the globe through wholesale, retail, outlet, and e-commerce channels.

Some key facts are:

Table 1: Sponsor Company Supply Chain Figures

Supply Chain Facts	US	APAC	EU
Factories	100	500	150
DCs	8	3	1
Pool Points	90	8	100+
Selling Points	10,000	689	4,200
In Scope	No	Yes	Yes

The company uses third party logistics providers to handle direct operations in APAC and EU regions. The APAC and EU DCs use compatible warehouse management systems (WMS) and have powerful data collection capabilities.

Benchmark Analysis

Nokia's aggressive reaction that utilized its relationship with Phillips and Li & Fung's utilization of its excellence in supplier management are great examples of best practice in supply chain disruption management.

In 1999, when Taiwan was hit by an earthquake that disrupted consumer electronics supply chains, instead of treating this problem as a purely supply-side one, Dell offered a special price incentive on product lines that would be unaffected by the disaster. This approach shows how a company whose strategy is demand-side-driven can use customer-oriented disruption management successfully, even despite the general industry mechanics.

Tang (2006) identifies two points in successful disruption management decisions. First, the cost of an action should always be compared to the benefit it would bring. Second, the action should achieve strategic fit.

Inditex is a Spanish fast fashion leader which owns famous brands such as Zara, Pull & Bear, and Bershka. The Inditex location that was visited has a massive 1,937,500 square feet of warehousing area and dealt with 180 million units during 2013. This location had an IT system resilience and recovery plan. However, like the Imaginarium and New Balance locations also visited, it did not have a formal disruption management plan for operations.

Qualitative Evaluation

Following the qualitative analysis proposed, results are reported through examples for each category taken from

the raw data of the interviews, an assessment was made for each evaluated category. Each category was then evaluated according to the overall presence of the attribute, with a scale from low to high, split into four ratings, from zero to three. A summary of the results are shown in Figure 3.

From the analysis, one of the lowest scores corresponds to the category 'Cost-Benefit Evaluation of Disruption Management'. There was no evidence from the interviews of a formal evaluation of cost for severe disruptions or cost-benefit plans to contain or recover from any disruptions in the supply chain network.

However, complex monitoring systems and high flexibility were also detected. Specifically, transportation flexibility and DC operations were key points that scored highly. Disruptions were also mitigated proactively through monitoring systems. For instance, port strikes have been well-monitored by the Global Transportation division and pending action has been adequately communicated to all relevant divisions so that proper evasive action could be taken.

Other identified areas that had potential for improvement were a recovery plan and redesign of recovery. The recovery plan area was lacking without a business continuity plan (BCP) that was known or readily accessible.

Quantitative Evaluation

The evaluation was done in three models:

1. Disruption financial impact by lost sales for 30 scenarios (agreed with the sponsor company).

2. Further consideration of the disruptions impact through the effects of Model 1 on share price of the company.

3. Contingency plan using total landed cost to determine the optimal temporary network under a disruption scenario. The figure underneath shows the logic behind this analysis.
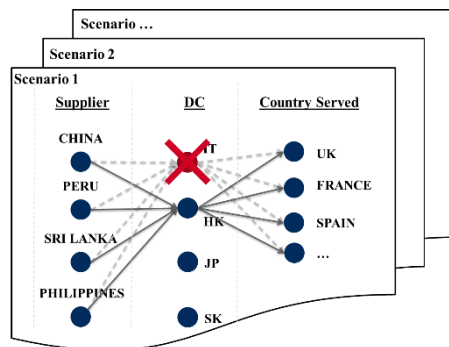

Figure 1: Illustration to Network Disruption Scenarios

The most critical disruptions found were the ones that involve the total failure of one of the DCs in the region. These key disruptions were further considered in the network contingency planning calculation. This evaluation will propose the best alternative DC to take over a disrupted one. The evaluation is done through a total landed cost calculation that includes transportation, inventory, handling, and duties. One of the most relevant cost in the network are the duties, and this became a key consideration when selecting an optimal temporary DC.

The graph shows the monthly costs of each potential solution, for the case that the European DC fails. It is clear

that duties make a huge difference between Hong Kong, Japan and South Korea. Other components such as inbound transportation decrease, due to the fact that most of the suppliers are located in Asia. Although the model optimizes based on cost, there are other qualitative considerations that temper this conclusion. For instance, the local 3rd party logistics partner in Italy has experience dealing with the especially high value brands that all funnel through Italy.
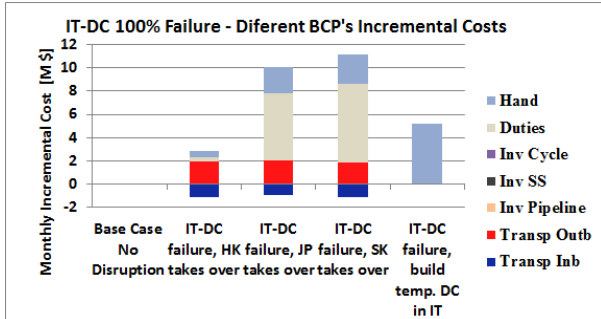

Figure 2: Europe DC Failure BCPs Incremental Costs

CONCLUSIONS

Through this study the company has received a thorough evaluation of the current state of its disruption management process for the EU and APAC supply chain networks. The categories and corresponding sub-categories with highest room for improvement were identified and corresponding recommendations proposed.
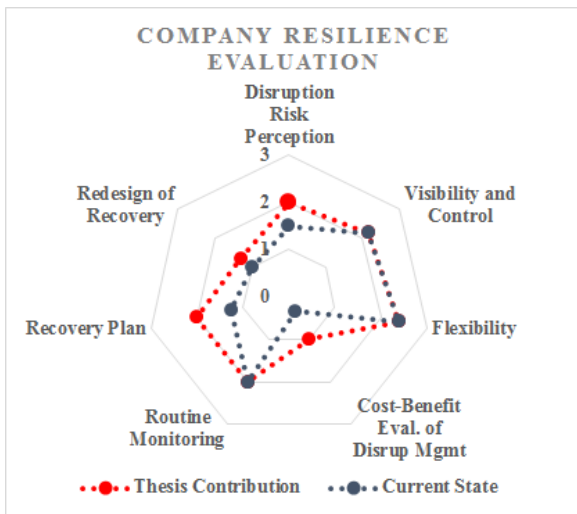

Figure 3: Company Resilience Evaluation

Additionally, two models were developed for the partner company to better quantify the consequences of multiple disruptions in terms of lost sales and share price impact. A third model in Excel was developed that selects the best DC alternative to support the operations of the disrupted one. The results are used to construct a BCP for such occurrence. Figure 3 illustrates the current state and thesis contribution on company resilience on a scale of 0~3.

Further contributions were made towards the industry as a whole. First, much of the analysis of the company reflects in areas that are common across most of the industry. Second, numerous examples were given and explained, how best practices should be adapted to fit the unique characteristics seen in the industry.

Table 2: Recommendations

CATEGORY	SOME RECOMMENDATIONS
Visibility	• Develop a resilience metric to measure the level of preparedness of the firm for a disruption. • Define an appropriate KPI for each department, in order to monitor the manager's performance in Disruption Management.
Flexibly	• Implementation of an operational feasibility project to allow critical DCs to take over operations of other regions' DCs • Avoid too much centralization of resources
Cost-Benefit Evaluation	• Gather data necessary to run the "Disruption Financial Impact" tool on a product level. • Add other real costs of the disruption such as brand reputation or market share loss.
Recovery Plan	• Construct a more detailed BCP for the DC failures scenarios proposed, including the set-up costs for the temporal contingencies studied. • Make a BCP at a product level • Discuss the BCP plan to all stakeholders: Building owner, 3PL, etc.

REFERENCES

[1] Chopra, S., & Sodhi, M. (2004). Managing risk to avoid supply-chain breakdown. *MIT Sloan Management Review*, 46, 53-61.

[2] Chopra, S., & Sodhi, M. (2014). Reducing the Risk of Supply Chain Disruptions. *MIT Sloan Management Review*, 55, 73-80.

[3] Cortez, K. (2012). Luxury industry and competitive analysis of ready-to-wear fashion. International University of Monaco.

[4] Ghemawat, P., & Nueno, J.L. (2006). Zara: Fast fashion. HBS No. 9-703-497. Boston, MA: Harvard Business School.

[5] Rice, J.B., & Caniato, F. (2003). Building a secure and resilient supply network. *Supply Chain Management Review*, 22-30.

[6] Sáenz, M.J. and Revilla E. (2014). Routing the routers: How cisco systems redesigned its supply chains to be more resilient. *MIT Sloan Management Review*, summer issue.

[7] Sheffi, Y. (2005). Preparing for the big one. *Manufacturing Engineer*, 84, 12-15.

[8] Simchi-Levi, D., Schmidt, W., & Wei, Y. (2014). Superstorms to factory fires: Managing unpredictable supply-chain disruptions. *Harvard Business Review*, 96-101.

[9] Tang, C.S. (2006). Robust strategies for mitigating supply chain disruptions. *International Journal of Logistics Research and Applications: A Leading Journal of Supply Chain Management*, 9:1, 33-45.

[10] Zsidisin, G.A., Melnyk, S.A., & Ragatz, G.L. (2005). *An institutional theory perspective of business continuity planning for purchasing and supply management. International Journal of Production Research*, 43, 3401-3420.