Increasing resilience from inbound supply chain disruptions. Learning from the past to get ready for the future

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Abstract:

Many companies do not suffer only the consequences of internal disruptions, but also the consequences of their direct and indirect supplier's disruptions. Managing intentional disruptions is more difficult, as you do not have the full control of the situation. The aim of this research is to understand why the severity of the same disruption is different for companies in the same industry. The research focuses only on inbound disruptions. The methodology used to achieve the research objectives is comparative case studies, respectively Dell and Nokia case study. Nokia and Dell faced an inbound disruption and they were able to handle successfully the disruption while their competitors could not manage to do so. The two case studies refer to past events, as their aim is to prepare managers to handle the future inbound supply chain disruptions, by learning from the experience of past disruptions. Managers should be aware that the best strategy for handling inbound supply chain disruption is a combination of resilience, company's culture, and organization structure. The findings of this research will outline the importance of company's culture and organization structure in handling inbound supply chain disruptions. No matter if the disruption is small or major, company's culture and organization structure will influence the

actions and strategies undertaken by the companies to handle inbound supply chain disruptions.

Key words: Nokia, Dell, inbound, supply chain disruptions, culture, organization structure, resilience.

1. Introduction

Supply chain disruptions have existed always, but only the last years they begun to receive special attention. The main reason was the increasing vulnerability of supply chains. Today supply chains are more vulnerable due to globalization and tendency to reduce costs (Revilla and Saenz 2014).

A recent global study (Business Continuity Institution 2014) concluded that 87 % of the organizations reported disruptions from Tier 1 supply, while 40 % reported disruptions from Tier 2 or lower. The reason was the increasing supplier dependence. It increases when a firm buys inputs from one or more suppliers that are difficult to be substituted. The benefits of this strategy are easy management and strong relationship. But in case of supplier problems, the firm will suffer losses as it will find difficult finding another supplier. The dependence from suppliers increases when their concentration is low or when the firm relies on single sources (Hallikas, et al. 2005). The Japanese companies, like Toyota or Honda, are well known for their strong relationship with suppliers. But this does not mean that they depend on a single source for everything, they have two or more suppliers for every component or raw material.

Many companies faced inbound supply chain disruptions and even if they were not totally prepared, they handled successfully the disruptions. Their competitors faced the same disruptions, but they recovered from the disruptions with significant losses or some did not recover. The research will try to understand why.

The aim of this research is to understand why the severity of the same disruption is different for companies in the same industry. How do they handle supply chain disruptions and on what depends their success in handling the disruption?

The study is structured as follow: in Section two we provide an analysis of the most relevant publications regarding categories and sources of supply chain disruptions, and later we focus on strategies for handling inbound supply chain disruptions. In Section three we will explain the rationale for choosing Dell and Nokia case study. In Section four and five the case studies will be analyzed. The other sections draw conclusions and recommendations for managers and future research.

2. Literature review

2.1 Supply chain disruptions: definition and sources

The most relevant definition for the purpose of this research is the one offered by Craighead et al. (2007):"Supply chain disruptions are unplanned and unanticipated events that disrupt the normal flow of goods and materials within a supply chain and, as a consequence, expose firms within the supply chain to risks".

The sources of supply chain disruptions are many. Considering different publications (Craighead, et al. 2007 Juttner, Peck and Christopher 2007; Hendricks and Singhal 2009; Revilla and Saenz 2014) the sources of supply chain disruptions can be classified in natural disasters, accidents and intentional. Supply chain disruptions can occur in each part of the supply chain, inbound logistics, outbound logistics and the internal process (Sheffi 2007). The following sections analyze the three categories of supply chain disruptions (inbound, internal and outbound).

2.2 Inbound disruptions

Inbound disruptions refer to supplier disruptions. Many companies do not suffer only the consequences of their direct suppliers' disruptions, but also the consequences of indirect suppliers' disruptions. The company buys components and raw materials from its direct suppliers. If a disruption happens to the direct suppliers, the consequences will affect even the focal company. For example, the Taiwanese suppliers after the earthquake were not able to produce memory chips. As result, they were not able to satisfy the demand for memory chips of many companies like Dell, Compaq, Apple. The indirect suppliers supply the direct suppliers with components and raw materials. If a disruption hit their supply chain, the consequences will be felt by the direct suppliers, and as a result even by the company. For example, a chemical spill at a chip plant contaminated a clean room and shut down the production. The little chips were used to produce the automobile keys. Without the chips, the keys could not be produced, and General Motor could not sell the cars. Inbound disruptions do not result only from disasters. In fast changing industry, the capacity can be low because of the time to change the plants in order to produce the new products. For example, Nissan was not able to produce the planned amount of the new cars in 2004, due to a shortage of steels. Inbound disruptions can derive from problems in communication, due to infrastructure problems. For example, the power blackout of 2003 in USA, created problems for many companies in their communication with the suppliers outside the USA territory (Sheffi 2007).

2.3 Internal disruptions

Internal process disruptions involve directly the company. They include disruptions in the manufacturing plants and assembly plants, if the company does not outsource the manufacturing and assembling phase. The sources of disruptions can vary from natural disasters to incidents. Internal disruptions sometimes

are related to human resources. For example, in 2004 Michael Dell resigned, and Kevin Rollins become the CEO while Michael Dell retained the title of chairman. During the management of Rollins, the performance of Dell was not as expected. The sales were growing but very slowly. Now days, the internal disruptions are increasing due to the vulnerability of the information technology systems. The main examples are the computer viruses, which has caused huge losses to many companies (Sheffi 2007).

2.4 Outbound disruptions

Outbound disruptions are related to demand and customers. They include massive decline in demand due to new technology, loss of customer confidence, competition and customer disruption. In 1982, seven people died, after having used the pain reliever of Johnson & Johnson. The company was obliged to retire from the market the entire product, not only in the area where the people died but in all the markets. Due to the loss of customer confidence, Johnson & Johnson lost hundreds of million dollars. More common are the cases, when many companies face demand disruptions due to strong competition that steal their demand and market share or due to customer disruption (Sheffi 2007).

2.5 Strategies for handling inbound supply chain disruptions

Inbound disruptions affect the supplier and focal company immediately following the event and over the long term. The financial consequences in many cases have short -term impact while the nonfinancial effects (brand reputation, shareholder concerns etc.) have devastating long-term impact (Business Continuity Institution 2014). For this reason supply chain disruptions and especially, inbound ones, need special attention. The first step in handling inbound supply chain disruptions is being prepared or resilient. How to increase

supply chain resilience from inbound disruptions? We will summarize the main strategies suggested from different authors.

Triple A supply chain: Lee (2004) stated that to increase supply chain resilience, the supply chain should be agile (able to respond to sudden events), adaptable to the external changes and aligned (aligning interest of all the members of the supply chain).

Supply chain incentives: It is not difficult to find the best suppliers but to maintain them. Everyone wants the best suppliers, so companies have to be able to maintain and strength their relationships with suppliers. One of the ways to do it is by offering supply incentives that can rank from economic incentives to moral incentives. Promises of long term contract, of ordering large quantities, rewarding the best suppliers are examples of supply chain incentives. Now days, suppliers are treated as part of the company, so if suppliers have a problem, the company will be there and if the company has a problem they will come to help the company solving the problem. It is important to build strong relationship with suppliers of critical components which are scarce and are supplied by few suppliers (Tang 2006).

Multiple sourcing: A strong debate exists for the best choice between multiple sourcing or single sourcing. Multiple sourcing can help to survive to inbound disruptions, as if something happen to one supplier the other is available, but it is costly and difficult to be managed (Sheffi 2007).

Collaboration with suppliers: Collaboration is necessary in normal times and especially during and after the disruption (Fawcett, et al. 2012).

When the disruption happened and finds the company unprepared, it is important to act quickly and implement a robust strategy. A robust supply chain strategy is a strategy that helps the company to manage the small disruptions in

normal conditions but also to manage the major disruptions by being both cost and time efficient (Tang 2006).

The research gap identified in the literature review is that very few researchers have considered why some companies are successful in handling inbound supply chain disruptions and some no. It is not a matter of having a resilient supply chain or having implemented a robust supply chain strategy. To design a strategy is easy but the execution is difficult. The same strategy cannot work well for each company. There are cases when companies operating in the same sector were hit by the same disruption, but some survived and some no. Their success was based on their organization structure and their organizational culture. So according to us, the best strategy for handling supply chain disruptions is a combination of resilience, organizational culture and organization structure.

3. Methodology

The methodology used is comparative case studies. The companies chosen for the case study are Dell and Nokia. But why these case studies and not others?

Firstly, Dell and Nokia are two larger electronics companies that faced an inbound supply chain disruption, respectively in 1999 and in 2000. On September 2001, two planes stroked and toppled the twin towers of New York City. It was one of the most terrible terrorist attacks of the modern history. After the terrorist attack, many research projects were charted to analyze the supply chain disruptions, especially the intentional disruptions, and their effects. The aim of the research projects was: how to be prepared for handling supply chain disruptions. After the terrorist attack, companies increased their awareness to supply chain disruptions, they created a special department for managing supply chain disruptions and also they spent time and money to build a resilient supply chain (Pickett, 2003). But, how the companies

faced supply chain disruptions before 2001, when the focus on supply disruptions was low compared to now? The case study of Dell and Nokia refer to years very near to 2001 but before 2001, so they are two perfect case studies for the purpose of this thesis.

Secondly, they were chosen, because Dell suffered a natural disaster disruption while Nokia suffered an accidental disruption. As it is said before the supply chain disruptions can be classified into three broader categories: natural disasters, accidental and intentional (Sheffi, 2007). Amongst these three categories, the intentional disruptions have been most extensively studied (Pickett 2003; Craighead et al. 2007; Steckea and Kumarb 2009) so therefore the other two categories offered interesting opportunities for further research. Both Dell and Nokia were able to handle successfully the supply chain disruptions, and also they gained market share after the disruption occurred. Dell became the number one in the computer industry in terms of market share while Nokia do not only gained market share but also brought out of the market one of its biggest competitors, Ericson. Why Dell and Nokia were able to recover quickly after the disruption hit them and also become more competitive? The case studies will address this question.

4. Dell case study

On 21 September 1999, around 2 am, an earthquake of a magnitude 7,6 occurred on the island of Taiwan. Papadakis (2002) estimated that at the time of the earthquake about 10% of computer memory chips were produced in the Hsinchu Industrial Park. In this industrial park were also produced in high quantities motherboards, notebook display, and other components. The market reacted quickly by increasing the price of chips because the demand for chips was bigger than the supply of chips. Immediately after the earthquake major

computer companies declared that they were pessimistic for their performance, and ability to satisfy customer's demands.

After the Taiwan earthquake, the suppliers informed Dell that they would not be able to deliver computer components (Y2K). Dell immediately found other suppliers for the same components, but it had to pay a high price. The consumers of Dell did not notice any component shortage problem, as Dell offered incentives, low prices and promotions, for computers that did not use the components that were not available. The strategy of Dell was "sell what you have" by using revenue managing through dynamic pricing and promotion (Pickett 2003). Its strategy has all the characteristics of a robust strategy: enable the company to manage small supply chain disruptions in normal conditions; increase the resilience of the company during major disruptions, and satisfy the customers before and after a major disruption.

Dell did not only handle successfully the supply chain disruptions but even gained market share after the earthquake (+22%) (Pickett 2003). The result of its success was the robust strategy that it implemented, revenue management. Dell was able to implement that specific strategy as it business model enabled him to do so. The organizational culture was another important factor of success. The sense of urgency, optimism and long-term relationships with suppliers and customers were the organizational elements of Dell's culture that determine its road to success.

5. Nokia case study

On Friday night, 27 March 2000, a lightning storm rolled through the Albuquerque city, in New Mexico. Lighting struck a Philip's industrial building. Philips could not fulfill the orders of its main clients, Nokia and Ericsson. At a first sight, it was forecasted that the delay will be a week, but in reality was more than one week. The delay would have caused significant losses

to Nokia and Ericsson. Nokia reacted immediately to the disruption while Ericsson reacted very late. As a result, Nokia gained market share (+14%) after the disruption while Ericsson abandoned the mobile market.

Nokia's officials in Finland noticed that some numbers were appearing on their computer screens, showing that the shipment of some components from Philips was delayed. On Monday, 3 days after the fire, Philips called Tappio Markki, Nokia's chief component purchasing manager, to explain the delay. Philips representatives gave detailed information to Nokia about the fire, telling them that the production would turn to normal levels within a week. One week delay is normal for global companies, so it would not be a serious problem as Nokia had some components in inventory. The customers would not notice the shortage of components (Sheffi 2007).

Mr. Markki wasn't very alarmed, but however he reported the event to Mr. Korhonen, Nokia's chief supply trouble-shooter. He always says "We encourage bad news to travel fast. We don't want to hide problems" (Latour 2001,3). The first thing that Mr. Korhonen did, was to send two engineers to the Philip' plant, in order to help them to recover quickly from the disruption. But Philips did not accept their help as according to them visitors would add confusion. Then Mr. Korhonen agreed with the officials of Philips to monitor and check daily their situation, especially the situation of the five components that Nokia source from Philips. In normal times, the monitoring and checking of components is done on weekly basis. Mr. Korhonen organized a meeting in Helsinski with Philips, and during the meeting he stressed the importance of strong and determined action to handle the disruption. The Philip's officials understood that he was angry for the disruption more than them, it was a matter of life or death for Nokia (Sheffi 2007).

Two weeks later Philips called again Nokia, to say that they have just realized that they would need more than two

weeks to restore everything. The production would have turned to normal levels after one or more months. If Nokia would not have the components, it would not be able to produce four million handsets, counting for more than 5% of their total sales at the time. They were really in a bad situation, but Mr. Korhonen did not give up. He organized an extraordinary meeting, to analyze more in detail the situation and to find a solution. Three of the five components were not critically as other suppliers could provide them, but the others two were critical as only Philips could produce them. He asked Philips if any of their facilities could provide the components. Some Philip's facilities in US and Japan could provide them but not in the quantity required by Nokia. The next action undertaken but Mr. Korhonen was the redesign of some chips, in order that they can be produced by other suppliers. Also, he worked on a project together with Philips. The aim of the project was to find new ways to boost the chip production, so when Philips will recover from the disruption, it could be able to produce more chips than before (Latour 2001).

On March 20, Philips called even Ericsson, to explain the situation. They provided detailed information to them and told that the delay will last one week. The chief component purchasing manager of Ericsson was not alarmed for the disruption and did not inform the bosses. After one week, they noticed that the delay was more than one week, but the low-level employees did not inform their bosses, as they bother their bosses only for important news. Two weeks, after the fire, Philips told to them that the delay will be at least one month. This was a big problem, the session of high sales was coming and they have to introduce the new phones. The bosses discovered slowly what was happing; they were informed only at the beginning of April. They immediately asked help to Philips, but it was collaborating with Nokia and it could not help them (Sheffi 2007).

Ericsson was not prepared for the disruption, it didn't have any reserve supplier for the components and all the other available suppliers were collaborating with Nokia. It was not able to handle the supply chain disruption (Latour 2001). How much did it cost to Ericsson the slow reaction? It declared huge losses in the mobile phone sector and was obliged to sell this division.

6. Conclusions

Nokia and Dell handled successfully the supply chain disruption. What can be learned from their experience?

First of all, inbound supply chain disruptions small or major merit special attention, companies should not under evaluate them. The Nokia case study is the best example, a small disruption happened but its consequences were very severe.

The severity of inbound supply chain disruptions depends on a number of factors. For example, Nokia and Ericsson faced the same disruption, but the severity of the disruption was high for Ericsson. Even Dell and the other companies in the computer industry faced the same disruption, but the severity of the disruption was low for Dell. Considering the case studies, it can be concluded that the severity of inbound supply chain disruptions depends on how prepared is the company to face disruptions and on how the company reacted when the disruption happened (actions and strategies implemented).

The preparedness of companies to face inbound disruptions depends on:
1. *Flexibility in finding suppliers*: refers to the ability of firms to find quickly other suppliers. Nokia and Dell were flexible in finding suppliers because they have good knowledge of the supplier market, and so they find quickly other suppliers.

2. *Flexibility in inventory*: means keeping inventory of critical components and products. This can be noticed more at Nokia, as Dell keeps nearly no inventory.
3. *Company's background*: Companies that have experienced disruptions or problems before are more aware of disruptions. So that the severity of disruptions will be lower for them, as they are always prepared for disruptions. Disruptions are part of their day to day business.
4. *Organizational culture*: Companies that have an individualistic and aggressive culture can handle better supply chain disruption as their culture stress the importance of flexibility in decision-making and sense of urgency. These elements are critical for handling supply chain disruption.

The success of the company in handling inbound supply chain disruption depends even on the strategy and actions that it implemented after the disruption occurred. Companies design different robust strategies to handle inbound supply chain disruptions. One size cannot possibly fit all, as one strategy can work well for one company, but cannot work well for the other. The successful handling of inbound supply chain disruptions relies on the ability to execute the strategy, which in turn depends on the company's culture, business model and organization structure. For example Dell implemented the revenue management strategy as its direct business model helped it to influence the acquisition decision of customers. Nokia would not have been able to execute such strategy, but it was able to implement the postponement strategy as it culture and organization enabled it to implement such strategy. But, the success in executing the robust strategies depends on:

1. *Human resources*: Human resources are an important part of the company. The first thing that has to be done when a disruption happened is to organize and mobilize

the company/human resources, which will answer to the external disruption.

2. *Working together*: More are better than one in handling inbound supply chain disruptions. Companies in the supply chain have to work as a team not as a group.

3. *Sense of urgency:* And lastly, but not less important, react immediately to inbound supply chain disruptions. One day, one week, one month can make the difference, as the Nokia case study had shown.

7. Recommendations for managers

Every company has to be prepared to face disruptions, as in this way it will reduce its vulnerability to disruptions. The following factors will help managers to reduce the vulnerability of the supply chain:

Increase flexibility of production: Inbound disruptions cause component shortage, and if the components are difficult to be found, the company cannot produce the quantity needed. It is important that the production is flexible, in order to adapt to the sudden changes in supply. The flexibility of production is increased when products share the same components and process and they differ only at the last stage of production (postponement). In this way, when there is a component shortage, the products can be redesigned quickly or when the demand is unstable, companies can produce standard semi-finished products and customize them when the demand will be more certain.

Always keep inventory of critical components. Critical components are the ones that can be produced only by few suppliers and are difficult to be found. Keep always redundant capacity, for important products that have unstable demand.

Continuously check for the weakest link in the supply chain: Today many supply chains are global and complex, so it is difficult to monitor and manage them. If one part of the supply

chain is weak, all the supply chain will be weak. The best suggestion to discover quickly the weakest link is collaboration and continuously information exchange with all the companies in the supply chain. By collaborating with all the partners in the supply chain, the company can help them to meet its objectives and also it will know them better. Companies need to collaborate in normal times and especially in difficult times.

Understand your business model and culture: Companies have different culture and different business model that sometimes help them to face disruptions and sometimes impose limits in handling disruptions. So it is suggested to understand who are the strengths and limits of the company's business model and corporate culture. When managers have to design strategies for handling supply chain disruptions, they have to consider these strengths and limits as the last ones will determine the success of the strategy execution.

Training and emergency teams: All the people in the company have to be trained in handling disruptions, and emergency teams have to be created. When the disruption will happen the emergency team will be focused on handling the disruption while the company will be focused on what it is good doing (producing or selling).

Learn from the other company's experience: A wise person learns from the experience of others while a fool learns from his experience (Sheffi, 2007). A successful company avoids doing the same mistakes done by its competitors. So, managers have to be keep informed about their industry and competitors. They have to analyze how the other companies in the industry reacted to several disruptions and how they can learn from the other's experience.

Being prepared is the first step for handling successfully a disruption. But what managers can do when the disruption happened?

Organize internally and then externally: When the disruption happened the first thing to do is to organize the

company to face the disruption; organize meetings to analyze the potential effects of the disruption and the best strategy to handle it. For example, Nokia first redesigned the chips (organize internally) and then it started to search for alternative suppliers (organize externally).

Teamwork: Work as a team not as a group. In a team people communicate freely with each other, give their opinion, have the same interests and objectives and trust each other. Nokia has worked as a team while Ericsson as a group.

Time is the scarce resource: When the disruption happened, there is not time to loose; every second is a matter of death or life. Companies have to react quickly when the disruption happened. A company that is prepared to handle the disruption can react more quickly.

8. Recommendations for future research

The first recommendation for future research is to consider companies from other industries, not electronic companies. Maybe considering an industry that is not very vulnerable to supply chain disruptions, for example, multi-domestic industries, such as agricultural machinery.

As inbound disruptions were studied in this research, it is better that the future researches focus on internal processes and outbound disruptions. This will be necessary to discover if companies handle in the same way inbound, internal processes and outbound disruptions.

During the research, it was discovered that two companies (Nokia and Ericsson) relied on one single supplier, that in the literature it is not suggested. But Nokia handled successfully the disruption even if it relied on one single supplier while Ericsson no. So, one interesting area for future research will be the problem of single sourcing versus multiple sourcing. The research will answer the question "Companies that rely on one supplier are more vulnerable to disruptions

compared with companies that rely on more suppliers?". Also, this research will be useful in helping managers to understand the best option for their company: single sourcing or multiple sourcing.

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