Analysis of Challenges in Existing Textile Retail Business for Implementing Sustainable Resilient Supply Chain

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ABSTRACT

The global retail business is extremely dynamic and this brings new issues in front of us and deserves responsibilities to address those issues. The Textile Retail Business is also experiencing this change as the whole retail textile supply chain has already become globalized with the time especially in terms of sourcing of raw materials and production as well. This phenomenon has raised the questions of threats regarding sustainability and resiliency of the supply chain. Today’s retailers are working closely with these topics in a competition basis to achieve competitive advantages in their supply chain. This dissertation aims to sketch out the possible latent challenges for which the companies prefer to work with a scattered supply chain in terms of different geographical location as it involves lot of time, transportation and risks too and it additionally disputes the total environmental and resilient approach of the supply chain and moreover to validate the inter-relation between ecological sustainability and resiliency of the supply chain. Based on the case study on two companies having different sizes but similar values towards environment which are also located in different geographical region, we have tried to find out the answers. Companies build up supply chain firstly evaluating flexibility and resiliency of their own supply chain only by considering the technology availability, quality and pricing involved with the product and then they want to be sustainable and resilient by addressing other issues. The main challenges for the companies to alter their position are the product specific characteristics, availability of know-how and the suitable process cost involved with product. It has proposed for the companies who are working with numerous supply chains located in different geographical location to do some adjustments among their nearby suppliers for a typical product on experimental basis especially providing technological and logistics support to their suppliers to attain more concrete approach towards their values that they believe.
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This thesis is written for the partial fulfilment of Master level Degree in Applied Textile Management at University of Borås, Sweden and is completed in May, 2010. It has been constructed during a certain period of time and these weeks have been instructive and fun, but at the same time intensive also. Moreover, it also demanded hard work and commitment in order to make our job something to be proud of and outstanding. We have had the opportunity to develop our skills and ideas within the field of Textile Management, especially on Supply Chain Management focusing on some critical issues in the industry. And we believe that this work will contribute to already existing research and as well as ideas for further research. This thesis would not have been possible unless the tremendous support from the several persons of various corner like academic, company, friends and family.

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1 Introduction

The textile and clothing industry is a diverse one; as much raw material it uses as the technology it employs. The whole supply chain is also quite varied in terms of time and geographical location and the chain usually consists of distinct activities. The whole process involved from design of product and sourcing of raw materials to distribution and marketing of the product is considered as an integrated network where each and every activity is contributing value to the end product. This entire process is highly dependent on different variables like costs, quality, reliability of delivery, access to quality inputs, transport and transaction costs. A typical supply chain of global apparel sector is demonstrated in Figure 1, where the dotted lines represent the flow of information, while the solid lines represent the flow of goods and the direction of arrow indicates a demand pull-driven system.

![Figure 1: The supply chain in textile and clothing sector](image)

How does the whole chain work? Here the information comes from downstream especially from customers and this articulates the product details and the production schedule. It is also noticeable
that information can flow directly from the retailers to the textile plants and vice-versa in many cases. At each link in the production network upstream to the distribution centre, there are several independent bodies who normally work as an individual company. To ensure smooth flow of goods, information and money throughout the chain, a number of good logistics and different business services are truly inevitable. Say, yarns can be bought from South America, knitting and weaving can be done in China and the garments making can be in China as well and at last the ready-made products are displayed in a store of an European retailer. And in this type of supply chain we will find lot of actors and also controlling the chain is simply tricky and challenging (Nordás, 2004).

1.1 State of global apparel retailing

The global market of apparel retailing is in the process of adaptation towards the changes. Traditional independent retailers are disappearing; whereas international multi-shop retailers with global product sourcing are grabbing the market share especially by promoting their own label collections. In the meantime, manufacturers are also becoming retailers themselves being vertically organized and enjoying complete control of the supply chain. Till now the physical store is the main structure of retailing though the several ways of retailing like e-retailing has introduced during the recent years. And at the same time, the retail sector is becoming more concentrated in terms of geographical location; competition is getting higher among the multi chain store and fewer players in the market. For example, Hennes & Mauritz, Lindex and Kappahl, the three retail giants together are controlling a major part of the Swedish apparel market. Now the companies are more focused on product innovation, upgrading of their product sourcing, merchandising and the outlook of their stores. The main means of competition has become brand strength, price, strength in logistics, customer service and store environment (Mattila, n.d.).

But the real challenge for the fashion retailers most likely is to sell more goods to the consumer who already has everything. At the same time they are also realizing that the consumer attitudes and shopping habits are changing with the time and the market becomes more volatile than ever. So, to be more consistent to acclimatize the unpredictable demand rising and falling, it’s the time for the retailers to rethink about their existing strategy to ensure the comfort of the consumers in the store and also to read out the latent needs of consumers (Mattila, n.d.).
1.2 Supply Chain Management

Supply chain is defined as “a network of organizations that are involved, through upstream and downstream linkages, in different processes and activities that produce value in the form of products and services in the hands of the ultimate consumer”. Supply chains allow the goods to be produced and delivered in the right quantities, to the right places, at the right time by efficient and effective working condition in a cost effective manner. The supply chains are complex networks, in which the products and information flows within and between the different nodes of the chain (Christopher & Peck, 2004).

Today supply chain management is emerging in a new dimension by having the sustainability as its primary focus, but previously it was acted only as a back office role of managing the logistics of supply chains. All the market players and new entrants of different market segments have already started concentrating on the environmental and social transparency in their supply chain. On the other hand they believe that this will increase the value of their products. Business of each company has improved in terms of improved customer base and supplier relationship by means of having the sustainable supply chains. Companies are motivated to implement the systems which ensure access to strategic markets and guide them to control the supply chain partners (Business for Social Responsibility, 2007).

Supply chain vulnerability has also become one of the significant issues for the companies nowadays. Due to the global outsourcing and market fluctuations, the supply chain becomes more complex and the sourcing risk also increases. Since, the outsourcing from the low production cost countries has increased in order to reduce the operation cost; the manufacturings are taking place far away from the company’s headquarters. Proper communication and understanding between the suppliers and the company has become the challenges to run the business and to attain mutual benefit (Christopher & Peck, 2004).

The success of a business is not only determined by the shareholder value and customer royalty and also by the external factors like the governments, media, civil society and consumers. These external forces are shaping the next generation of supply chain management. The products and services provided by the companies are expected to be more sustainable during using and
disposing. The products need to be produced, packed and transported in an ethical way which should not harm social balance and environment.

Now, the new challenges for the supply chain managers are to achieve an efficient and effective supply chain that will be resilient enough to bounce back from any disruptive situation and also should have sufficient vigilance to offer more sustainable products to its customers. And in order to fulfil them in a typical supply chain, the companies and their supply chain partners need to adjust their system effectively.

1.3 Definition of sustainable supply chain

A sustainable supply chain is

“A system of aligned business throughout the lifecycles of product that creates values for all stakeholders, ensures ongoing commercial success, and improves the wellbeing of people and environment” (Business for Social Responsibility, 2007).

“Management of raw materials and services from suppliers to manufacturer/service provider to customer and back with improvement of the social and environmental impacts explicitly considered” (New Zealand Business Council for Sustainable Business Development, 2003).

Sustainable supply chain provides the focus for any organization, which is whether service or product based, seeking to improve the social, environmental and economical performance of its operations.

1.4 The Concept of resilient supply chain

Resilience is ‘the ability of a system to return to its original state or move to a new, more desirable state after being disturbed’ (Christopher & Peck, 2004). Resilient supply chain is the flexible supply chain which adapts to the external situation and makes the company to perform well in the market place. It may be different from the original state by using the market opportunities and by tackling the external turbulences.
1.5 Delimitation

In order to focus on a particular element to get an in-depth knowledge and achieve good result we have delimited our research work. Out of three pillars of sustainability namely Ecological, Social and Economic sustainability, we are focusing only on the ecological sustainability.

WHY? Due to the global warming and increase in natural calamities, environmental focus is more important than others. There are various factors to measure the effect of environmental damages, like energy consumption, carbon footprint and wastages. To further delimit our work we concentrate only on carbon footprint related to transportation. So our focus is to analyse a typical supply chain through case study on companies and to find out the challenges that the companies face to achieve sustainability from ecological point of view and resiliency during demand fluctuations in their supply chain. We also try to figure out whether it is possible to connect sustainability with resilience or vice-versa.

To sum it up:

1. Sustainability in supply chain from environmental perspective which will be assessed in terms of carbon footprint due to different geographical location and resiliency in supply chain to address the disruptions in the demand side due to the unexpected demand rising or falling which is external to the company and internal to the supply chain.

2. Case study on supply chain of Patagonia for Polo-shirt and Klättermusen's organic cotton jacket.

Reason to choose Patagonia:

We were interested to learn about Patagonia when Yvon Chouinard and Jill Dumain spoke at The Design of Prosperity Conference in November, 2009 at University of Borås. We were inspired to learn that Patagonia is both a well-known outdoor clothing brand and respected for its care
towards the environment. Moreover it is the only company that transparently provides the carbon footprint details that enable us to begin with a usable base of information.

*Reason to choose Klättermusen:*

Klättermusen is a Swedish company working with environmental issues and also well known for its eco-friendly approach. For us, it is wise to have a study on several companies that have the similar ideology to get more close and precise scenario to develop concrete concept regarding our work. From this point of view, to get something remarkable we approached Klättermusen for our case study, since it is in different geographical location than Patagonia and also size of the company is dissimilar comparing to Patagonia.

And here we have made a comparative study on the supply chain of Polo shirt and Einride Jacket of Patagonia and Klättermusen respectively.

2 Research Question

*Why even the companies who work with environmental issues prefer a supply chain that is scattered around the world knowing its possible environmental impacts and disruptions?*

3 Methodology

Our research has carried out by collection of various data through literature review in order to answer our research question. We have also done a case study analysis on supply chain of two companies, figure out causes and impacts of existing supply chain, develop a theory of alternate suitable supply chain with reduced environmental impact and relate the supply chain with resiliency. We have done qualitative research analysis to discuss and find the results. There are various methods have been involved in our research work and are stated below step by step.
i) Archival method of data collection

Normally archival method is used when the data is available in collection or archive form. We have collected various data from Patagonia's Footprint chronicle, Klättermusen website and also from our literature review to analyse the sustainability issues in the supply chain.

ii) Qualitative analysis

Qualitative method allows the subjects being studied to give much ‘richer’ answers to questions put to them by the researcher, and may give valuable insights which might have been missed by any other method. It is based on the theoretical data and provides valuable information to certain research questions in its own right (QSR international, 2010). From the data which we have gotten, we have analysed the supply chain of Patagonia and Klättermusen for the products Polo shirt and Einride jacket respectively. The analysis is based on environmental sustainability and resilient of the supply chain. Then we have prepared questions to the companies for interview relevant to our research questions.

iii) Questionnaire method

In questionnaire method we have to set up a questionnaire relevant to our research and ask the respondents to answer those questions. This is very cheapest and flexible method. We have prepared two different set of questions to Patagonia and Klättermusen. We have sent the questions to Patagonia through Mr. David Goldsmith to the get their response and we sent the questionnaire to Klättermusen directly.

iv) Case study method

The case study method provides a systematic way of looking at issues, analysing information, and reporting the results. We have carried out an in-depth investigation on the interview responses to explore causation in order to find underlying principles. We have gotten the reasons behind the happenings from the results and also those results helpful for the future research. We have also generated and tested two hypotheses.
4 Literature Review

4.1 Vulnerabilities and disruptions in existing supply chain

Today’s textile supply chain is more complex than ever due to global sourcing and consequently it has become vulnerable in terms of uncertainties. Geographically, coping with the dissimilar nature of various issues regarding environmental, technical, political, social, economical, national and international security has become a most crucial challenge for the existing supply chain of textile business. Apart from this, the existing supply chain is also experiencing frequent disruptions due to attack of different forces from inside and outside of the organization and ultimately the number of disruptions is endless. As for example, retailers can be suffered by the manufacturer’s disruptions and the manufacturing can be disrupted directly because of some problem in their plant, disruption at their supplier’s plant, malfunction in the transportation system, interruption to the communication and information system, or snag with customer and it can also be disrupted indirectly due to disruptions of intermediate suppliers that take capacity out of the supply chain (Sheffi, 2005).

![Figure 2: Simplified supply chain network (Sheffi, 2005)](image)

Any company who involves in this type of supply chain; be it automobile manufacturer, shoe maker or an apparel retailer- the chain has three main sections:

- The inbound or supply side of the supply chain includes all activities of all tiers suppliers to deliver the raw materials, intermediate parts or finished products to the next hand.
The internal processes or the focal organization are responsible to integrate and communicate with upstream and downstream.

The outbound side of the supply chain comprises with all the distribution processes and the customers of the company.

So, disruptions can be realized in companies and processes due to the disturbances of any section of this chain that connect raw materials sources to the ultimate end-user of the finished product (Sheffi, 2005).

### 4.2 Disruption in supply

Disruption of supply can happen due to the consequences of the disruptions not only the suppliers but also the supplier’s supplier. The notion of this disruption may be seen due to various reasons like natural disaster, accidents, lack of information sharing, unexpected demand rising or falling, capacity shortage of the plant, prolonged lead time etc. As for example, in 2004 Japan’s second largest car maker NISSAN suspended three of its four Japanese plants due to shortage of steel. This shortage was caused mainly by the huge demands created by over-heated Chinese economy (Sheffi, 2005).

### 4.3 Disruption in internal processes

Internal disruptions which happen within the company have a special dimension because in many cases they involve company personnel who are in harm’s ways. It may be the internal infrastructure like production facility failure due to the attack of a powerful tornado or it may be the unexpected loss of key personnel of the company due to tragic accident or some other reason. For example, Akami lost its co-founder and chief technology officer in the 9/11 tragic plane crash. The bond trading company Cantor Fitzgerald of U.S.A experienced a disruption of a different magnitude when it lost 658 people in the collapse of the World Trade Center. In addition to the human toll, it relates to the loss of relationships with employees, customers and suppliers which are really crucial to recover (Sheffi, 2005).

Nowadays, we are heavily dependent on information technology to be interconnected with our all networks but sometimes this can be vulnerable to computer viruses, software problems, and other technology outages. In January 2003, a computer worm named as SQL Slammer spread directly
to vulnerable computers through internet and needing no human intervention, Slammer infected 90 percent of vulnerable hosts within 10 minutes of its first appearance. Slammer downed Seattle’s 911 call centre, American Express’s customer service, and Continental Airline’s computerized reservation system (Sheffi, 2005) & (O’Harrow & Cha, 2003).

4.4 Disruption in demand

Disruption in demand is largely experienced by a company when it faces massive, unpredictable declines in the demand for its products or services. These may come up due to the technological changes, new entrants, disruptions to a major customer, or the sudden loss of customer confidence. But if anything happen all on a sudden from customer side like customer losses confidence on a certain product or if the customer himself or herself entangled with commotions, then it will be really catastrophic for a company (Sheffi, 2005).

Equally, demand imbalances which may be considered as unexpected spikes in demand have a slight impact on a company’s existing structure though it can lead to lost sales, bad service, and even lost customers (Sheffi, 2005).

In 1982, Johnson and Johnson (J&J) enjoyed a 37 percent share of the non-prescription market with its popular pain reliever, Tylenol. But in late September of that year, seven people died when someone placed bottles of cyanide-laced Tylenol capsules on store shelves and on this consequences J&J pulled off all their 31 million bottles of Tylenol bottles from the market and it caused J&J’s share of the market to drop to 8 percent and its stock market capitalization to drop by 7 percent. But by the end of second quarter of 1983, as a part of aggressive marketing, J&J came back to its market and regained its original position with heavy promotions by redesigning the packaging and switching from powder filled capsules to solid caplets (Sheffi, 2005).

4.5 Categorizing the supply chain risks

The supply chain network is innately vulnerable to different risks entangled in all the ways of a chain in a dissimilar form and the failure of any one element or any disruption in any node of a chain can cause the whole network to fail. So, the categorization and mapping out the likelihood and impact of risks are the challenges of today’s organization to figure out how to deal with.
According to Mason et al. (1998) and Cristopher and Peck (2004) the supply chain risk is subdivided in five different categories:

- Process risks internal to the company;
- Control risks internal to the company;
- Demand risks external to the company and internal to the supply chain;
- Supply risks external to the company and internal to the supply chain;
- Environmental risks external to the supply chain.

As we know, a company is the unification of different processes and activities and its main aim is to ensure incessant value creation to its products as a part of its business strategy. Here the process risks include all activities that a company does in its various operations connected to manufacturing, warehouse management to transportation and at the same time the control risks are apparently connected to process risks. Say, the warehouse management is functioned by using inventory control policies; in fact each process within a company has specific rules and controls and the breakdown of any of these act as risks which affect the performance of the company and also its resilience. Wrong demand forecast methodologies, inadequate production planning, mismatch of corporate culture and implementation of quality methodologies and systems are some of the attributes that are causes of process and control risks for a company (Longo & Ören, n.d.).

Demand risks normally add up the flow of products, information and finances from the next customer of a focal firm and it is in downside of a chain regard as external to company activities but connected with its activities as a part of a chain where the supply risks indicate all disruptions as like demand risks but in this case, it happens in the upstream of a supply chain (Longo & Ören, n.d.).

Finally the environmental risk is considered as uncontrollable and sometimes unpredictable event that strongly affect the supply chain vulnerability and resilience. It also influences the total network being not a part of a chain (Longo & Ören, n.d.).

Moreover, it is quite difficult for any organization to have a clear scenario of the likelihood and consequences of each disruption and to work with it. So, to adapt and have advanced
preparedness, the company needs to prioritize these dissimilar attributes of disruption and it can be sketched out in terms of disruption probability versus consequences in the following two axis diagram:

![Disruption Probability vs Consequences Diagram](image)

**Figure 3:** Vulnerability Map For a Single Company (High impact/high disruptions etc) *(Sheffi & Rice, 2005)*

As we know, still most of the companies only work on their own vulnerability but the above map depicts the whole global scenario and helps the company to focus its planning efforts on sensitive region and also helps to spot a problem area at a glance to respond quickly.
4.6 Resiliency in supply chain to cope with the disrupted global supply chain and to reduce vulnerability in the business

Still many companies rely on luck to overcome from a disastrous supply chain disruption. But in today’s business environment, it is imperative for an organization to build up a supply network that is well equipped with comprehensive security measures and is as well resilient enough to bounce back from any disruptions. As in reality, luck can hardly save you and show you the right way to manage your business. It means the supply chain has advanced security processes and procedures in place, while at the same time it is resilient enough to respond to unexpected disruptions and restore normal supply network operations; as a secure supply network does not guarantee a resilient supply chain, and vice versa (Rice & Caniato, 2003).

Resilience is considered as a competitive advantage than the competition; following a disruption and it helps a company to capitalize on opportunities to serve its competitors’ customers when its competitors fail to adapt with the embarrassed market situation. Even in some cases where the disruption affects the company and its competitors equally, companies can compete on their resilience capabilities. In early 2000, Nokia and Ericsson experienced such type of disruptions as the both competitors depended solely on Philips Electronics for radio-frequency chips (RFC) and were thus equally affected by a fire in the main Philips RFC plant. But to react with this situation, their responses were quite different as Nokia immediately sensed the disruption and responded aggressively, dedicating 30 employees to work with Philips and other suppliers to maintain a steady RFC supply. Ericsson, on the other hand, did not sense the seriousness of the disruption and ultimately mounted only a modest effort to restore supply. The net effect was that Nokia achieved its sales plans, while Ericsson missed a critical new product introduction that amounted to an estimated $400-million-revenue loss and Ericsson ultimately exited from the business of making cellular phones (Rice & Caniato, 2003).

A company can achieve resilience in its supply chain by adapting numerous practices, but of all the ways to become resilient, two methods hold the greatest potential; one involves redundancy and the other is flexibility. And here the company needs to decide the right approach that fits with its strategy and organizational structure.
4.7 Resilience through Redundancy and Flexibility

Redundancy helps companies to respond to disruptions and continue its services during the recovering period after a disruption. Companies mostly practice to protect themselves by keeping spare inventory and in some cases by maintaining production lines or facilities in excess of capacity requirements, committing to contracts for material supply (buying capacity or subcontracting), and maintaining a dedicated transportation fleet (Rice & Caniato, 2003). But nowadays companies are working to cut costs by eliminating exactly this type of inventory rather than more focused on tightly connected supply chains and higher quality of products and services. In some extent, some companies decide to keep a lean supply chain with little inventory and a single supplier. They do this even for a critical paths based on the rationale where the full cost of handling several suppliers and keeping safety stock are too high (Rice & Caniato, 2003) & (Sheffi, 2005).

In real time situation, safety stocks work as a tool of resiliency and offer companies enough space to plan to continue its business, even a small amount of inventory can do so. Sometimes redundant capacity is really beneficial for a company to face a critical situation but it depends on the nature of business though we know a high level of redundancy is too expensive. Say, in case of information technology, company should keep complete redundant capacity as the stakes are especially high and the costs of extra capacity are relatively low here (Rice & Caniato, n.d.) & (Sheffi, 2005).

On the other hand, flexibility also increases resilience by building capabilities within the organization to respond quickly to disruptions. Companies develop these types of capabilities through the investments in infrastructure and resources in beforehand. Developing a multi-skilled workforce, designing production systems to cope with multiple products with real time changes, and adapt with different sourcing strategies to switch to a new supplier are some examples of such capabilities. But these capabilities will not function until the company ensure fundamental changes to its entire organisation and as well as its supply chain partners. It means close partnership is only with suppliers who work with the company more firmly as per its changing demands in troubled times (Rice & Caniato, 2003) & (Sheffi, 2005).
In due course, company will likely adopt a mixture of these flexibility and redundancy alternatives, depending on different cost and service characteristics as well as on specific business and industry factors.

4.8 Challenges to implement sustainable resilient supply chain in all level of a business

Strategies that companies wish to implement in its supply chain to achieve resiliency are opposed by different forces from various levels of business and mostly comes within the organization.

4.8.1 Trade-offs between cost and benefits

To some organizations, it’s sometimes a challenge for them to balance between the additional costs to implement strategies to achieve a more resilient supply chain and its feedback during the troubled time. Theoretically, these approaches optimize the company’s competitiveness especially when its supply chain is more vulnerable to disruptions but at the same time quantification of the value of its competitiveness is really imprecise. Moreover, it is viewed as “insurance premiums” that will safeguard the supply chains from major disruptions (Sheffi, 2001). In other sense, additional facilities can reduce efficiency and sometimes lower the competitiveness. Here the challenge is to choose the right set of strategies and trade-offs between the losses caused by reduction in efficiency and the benefits that a company gets from increased robustness. It is not clear that which strategies can reduce risks without hurting efficiency (Sheffi et al., 2003) & (Stecke & Kumar, 2006).

4.8.2 Strategic fit

To mitigate risks and probable disruptions in a critical moment, an organization must think about the strategies that fit with its business policies and as well as its communicating message which used in its mission. Say, a company work on postponement principle and to lessen risks if it decides to reduce its product variety as a way to rationalize its lines, then the value of postponement strategy is diminished. We can mention another example here, say a retailer has a slogan “every day low price”; but in a critical moment if it moves for dynamic pricing and promotional strategy, then it is simply incongruent to its strategic position in the market place (Tang, 2003).
4.8.3 Proactive execution

An organization has to be practical enough to respond beforehand in a proactive manner; otherwise robust strategies will not bring expected benefits for it and even in some cases, competitors have the opportunities to be profitable by utilizing this advantage (Tang, 2003).

4.8.4 Leadership over the organization

During the catastrophes, most internal and external operations of an organization have become decentralized and then it is crucial to play the role from the management side to have direction and control on overall situation. Here the management tasks are to identify emergency services that needed to tackle the situation and ensure its implementation. The management also has to take steps to meet up post emergency period and quantify the amount of existing resources. Above all, centralization and integration of materials and information is a must here (Tang, 2003).

4.9 Recent disruptions and different scenarios from different business sectors

Iceland Volcano was a recent incident that started on April 14, 2010 and all we know that it had a tremendous impact especially on Airline companies. But the reality was that it not only crumpled airline business but also the overall global businesses. We can recall the total synopsis of different business sector from different corner of the world (Callus, 2010).

Peter Grundhoefer, a wholesaler in Frankfurt, said: "This affects all of us in the fruits business. We will lack beans and pepperoni from Egypt and fresh herbs from Israel, exotic fruits like mango, kumquats and physalis (cape gooseberry) once stocks have been used up in the next one or two days." Barbara Hennings, who works at Frankfurt sushi restaurant Iroha, told that exotic vegetables were a bigger problem than fish. She added "So far we're not experiencing any supply bottlenecks and we do not have to take dishes off the menu." She told that tuna was delivered frozen once a month from Spain so there was no impact (Callus, 2010).

But for IKEA AB, it was quite different from others as their transportation of goods was only by ship, rail and truck, so the Swedish furniture retailer not experienced any supply disruptions. German fashion brand Hugo Boss AG expected a delay in showing its pre-spring collection to retailers such as Macy's Inc and Nordstrom Inc, but a U.S. spokesman said there would be no
impact on stores since those clothes would not actually ship until the 2010 holiday season (Callus, 2010).

Dutch mail group TNT NV told that it had switched to road transport in Europe and was incurring higher costs. Anita Gupta, Asia Pacific spokeswoman for rival DHL in Singapore told that the group had increased its trucking capacity to minimize delays for shipments within Europe. Three to five days delay was expected for shipments moving between Europe and the rest of the world (Callus, 2010).

"Many hotels have been booked out since Friday," said Petra Winter, a spokeswoman for the Frankfort tourism office. Of 140 hotels with more than 34,000 beds in Frankfurt, only 20 had vacancies. Car rental companies experienced a surge in demand as travellers try to find substitutes for flights. "We are buying new cars for this" by taking on sooner than planned deliveries of cars the company already agreed to buy, a spokeswoman for Europcar in Hamburg said (Callus, 2010).

Japans’ Fujitsu Ltd told that its notebook PC shipments to Europe had been halted temporarily due to the disruptions. It said that there was enough inventories in the region to ensure their sales and it would be no impact on earnings at that moment. Sony Corp, Sharp Corp, Hitachi Ltd and Panasonic Corp said that they experienced no impact (Callus, 2010).

International Air Transport Association (IATA) said that the economic impact on airlines was greater than the Sept. 11, 2001 attacks (Callus, 2010).

The global Civil Air Navigation Services Organisation (CANSO) said that the air traffic control sector lost up to 25 million Euros ($35 million) a day due to the closure of European airspace and had warned of a significant impact on future investments (Callus, 2010).

4.10 Recent development and current scenario of companies that are working with resiliency

The retail environment is a complex and dynamic one; every day brings new challenges and opportunities to this sector. To address these challenges and bounce back from these disruptive
events all are doing their best. This is really incredible, varied and innovative in respect of the nature of the challenges, organization’s strategic position, and geographical location.

4.10.1 Wal-Mart recent development

The need to have a resilient supply chain for the world largest retailer Wal-Mart is not merely theoretical but mostly it is a challenge for the company as it moves enough inventories to support $1.1 billion in daily average sales, $12,747 per second (based on total sales for the fiscal year ending 2009) everyday. On a weekly basis 200 million customers pass through the doors of its 7,800 retail and wholesale outlets in 16 countries on four continents, and its tens of thousands of suppliers source goods from around the globe. With this many moving parts, disruptions due to transportation issues, natural disasters, political instability, environmental conditions and hundreds of other causes are an everyday’s incident (Koon, 2009).

It is simply amazing that Wal-Mart is successful in this battle. So, how it is managing these mammoth jobs, what are their strategies behind this success? That is really a matter of deep understanding and investigation (Koon, 2009).

Firstly, Wal-Mart is consistently focused on removing logistics cost connected to production and transportation of products. In their last annual report, it was revealed that Wal-Mart increased its yearly sales by $27 billion (an increase of 7.6%), while reducing inventory by $648 million (a reduction of 1.84%). We know that this type of reduction leads to greater profits and at the same time increase the vulnerability. So to meet up the needs of emergency period, Wal-Mart has set up nine disaster distribution centre located around their sales countries to store supplies that are vital to communities during a disaster – such as water, batteries, flashlights and generators. This helps to ensure more immediate availability of essential products for its customers. Previously Wal-Mart responded to the needs of citizens in an impacted area through multiple channels. It responded through the normal means at stores and clubs, but also through donations to charitable organizations such as the American Red Cross and Salvation Army, and through sales of merchandise to emergency management agencies at the local, state, and federal level (Koon, 2009).
Secondly, continual communications throughout the supply chain, both internally and externally are vital to the success of Wal-Mart's efforts. Many of its suppliers have offices in Bentonville, Arkansas, where Wal-Mart's headquarters is located. This co-location helps to ensure that suppliers are able to maintain a rhythm on the company's current and future operations and to adjust their supply of product accordingly (Koon, 2009).

As a part of Wal-Mart’s sustainable approach, the company has decided to reduce the packaging size of the thousands of products and this initiative has enabled Wal-Mart and its suppliers to have an extra capacity on each shipping container and each truck and to utilize it during surges in demand, adding to the resiliency of the entire system. The company is also reducing its reliance on fossil fuels, in its trucking fleet and at its stores and Sam's Club locations. By reducing the dependency on any single source, the resiliency of the entire system is improved (Koon, 2009).

As a part of its enhancement of resiliency within the supply chain, Wal-Mart is planning to use GPS transmitting device and other information systems in its transportation system. The system will track weather conditions around the country, the status of emergency merchandise orders during a disaster, road conditions or will provide real-time notifications based on pre-defined parameters to take necessary steps instantly during a disastrous period (Koon, 2009).

Finally, Wal-Mart is trying to be more focused on the continued integration of the private sector into the emergency management efforts in its operating countries. This will allow to take better decision during planning and operational levels. Ultimately these insights will once again move the system toward greater resiliency, by being able to issue all available information into its operation. At the same time, the company is also working on supply chain visibility to be more resilient. As a part of its work, the company has recently announced to provide product rating system that determines the environmental costs of production. It will encourage educated purchasing decision and will initiate a new level of transparency throughout the supply chain (Koon, 2009).

4.10.2 McDonald's business strategy in India

McDonald’s launched its business in India in 1996 and it was in profit after it broke even in 2008; on that fiscal year the total losses were Rs. 211,41 Crore ( USD 45,19 billion). But at that
moment, it was thought that India and China would continue to be high-growth markets for McDonald’s and the top management also could realize the tremendous brand success. So, in September 2009, it came to introduce a new pricing strategy for its lunch and dinner menus; reduction in prices by almost 25%. On that moment, it was surprising as it came at a time when food prices were increasing day by day. Others thought that cutting prices in such times did not make sense. But the management in India was convinced that tweaking the prices of its combo meal offering would help customers prefer McDonald’s as a lunch and dining destination (McDonald’s, 2009).

4.10.3 SAS’s social media utilization in a crisis

Social media can be a great asset in communicating with customers when all other communication tools become quiet. Perhaps the full power of this tool comes as the best way to bring light in times of disaster, when up-to-date and current information is crucial to get as many as possible and as soon as possible (Husdal, 2010).

New launches are always accompanied by time demand. But for Scandinavian Airlines (SAS) the timing of the launch of its Facebook page could not have been better planned as it was launched on April 14; the day before the volcanic ash cloud paralyzed both European and much of global air traffic. At the end SAS fully utilized the power of social media to keep its passengers informed on the latest developments, and answer all sort of questions from stranded travellers. The Facebook page also had a link to the latest update on flight departures, something that otherwise is hard to get by the commuters (Husdal, 2010).
4.11 Dissimilar attributes of disruptions in the demand side of a supply chain

To go for a decision to make products or place an order before reaching the actual demand from the downstream is really challenging for retailers and also the toughest part of supply chain operations. As we know too much products means that it will have impact on inventory carrying costs and ultimately lead to discount offer. Equally the shortage of inventory causes lost sales and finally directs to lose customers. Actually, the retail supply chain is truly vulnerable to demand related risks that are primarily transpired due to demand variability and unpredictability; and both are connected with several independent trends.

4.12 Demand Variability

- General marketing campaign or advertisements connected to promotional offer can affect short- to medium-term demand.
- News about product hazards (for example, allergic reaction for animals, human body, susceptible to children) can be infrequent but has a large impact on the demand. As for example, in the middle of 2007, two Chinese toy manufactures were banned from exporting by the Chinese Government as they were warned and recalled by the overseas buyers from Asia, Europe, and U.S.A due to lead contamination in toy paints. The government came to that decision to safe-guard and warn its other’s businesses. Through that act the whole toy business of china was somehow disrupted (msnbc, 2007). On January 5, 2007 it came to news that Samara Brothers, a Chinese Garments Manufacturer was recalled by the U.S. Consumer Product Safety Commission. I was due to the coatings on the snaps of all products which contained excessive amount of lead posing a serious risk of lead poisoning and adverse health effects to young children. Below is the Recall Alert letter from U.S. Consumer Product Safety Commission to the company (Samara brothers, 2007).
Recall Alert
U.S. Consumer Product Safety Commission

January 5, 2007
Alert #U7-516

Samara Brothers Recalls Children's Two-Piece Overall Sets, Snaps Contain Lead

The following product safety recall was voluntarily conducted by the firm in cooperation with the CPSC. Consumers should stop using recalled products immediately unless otherwise instructed. It is illegal to resell or attempt to resell a recalled consumer product.

Name of Product: Starting Out Shirt and Overalls
Units: About 200

Manufacturer: Samara Brothers LLC. of New York, N.Y.

Hazard: The coatings on the snaps in the overalls and shirt contain excessive amounts of lead, posing a serious risk of lead poisoning and adverse health affects to young children.

Incidents/Injuries: No incidents or injuries have been reported.

Description: This recall involves two styles of children's overall sets. One set is a red plaid denim overall with a white shirt trimmed in red, sold in sizes 12 through 24 months. The other set is a navy blue corduroy overall with a white shirt trimmed in green, sold in sizes 3 through 5 months. Both styles have decorative train appliques on the front of the overalls. The collar tag of the overalls reads, "Starting Out."

Sold Exclusively at: Dillard's nationwide during October 2006 for about $20 for the red overalls set and about $25 for the blue corduroy set.

Remedy: Consumers should stop using the products immediately and contact Samara to obtain a full refund.

Manufactured in: China

Consumer Contact: For additional information, please contact Samara Brothers at (800) 961-9973 between 8:30 a.m. and 5 p.m. ET Monday through Friday, or visit the firm’s Web site at www.samararecall.com or email the firm at info@samararecall.com

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CPSC is still interested in receiving incident or injury reports that are either directly related to this product recall or involve a different hazard with the same product. Please tell us about it by visiting https://www.cpsc.gov/cgibin/incident.aspx

The U.S. Consumer Product Safety Commission is charged with protecting the public from unreasonable risks of serious injury or death from thousands of types of consumer products under the agency’s jurisdiction. The CPSC is committed to protecting consumers and families from products that pose a fire, electrical, chemical, or mechanical hazard. The CPSC's work to ensure the safety of consumer products - such as toys, cribs, power tools, cigarette lighters, and household chemicals - contributed significantly to the decline in the rate of deaths and injuries associated with consumer products over the past 30 years.

To report a dangerous product or a product-related injury, call CPSC's Hotline at (800) 638-2772 or CPSC's teletypewriter at (301) 595-7554. To join a CPSC e-mail subscription list, please go to https://www.cpsc.gov/epubsub. Consumers can obtain recall and general safety information by logging on to CPSC's Web site at www.cpsc.gov.
• Outbreak of diseases like avian flu, mad-cow can severely affect demand of products related to them. These are infrequent type of risks but can have a long-lasting effect. On January 01, 2001, it was revealed in Wall Street Journal that McDonald’s profit fell down as European sales were damped by fears of Mad-Cow disease. In an interview, McDonald’s Chief Executive Jack Greenberg said that sales had largely recovered in France, but they were still suffering in Germany and other countries and he also mentioned that it was hard to predict that what it would come to a normal situation (Ordonez, 2001).

• During the usage of clothing products quality issues like colour fading, unravelled hem, loose button, jammed zip and so on can create a negative impact on the particular brand and sometimes that retail brand may lose a big number of its customers. On 2nd February 2009, it was reported in a British newspaper named ‘Mail Online’ that a total of 14,390 disgruntled shoppers called the Government’s consumer helpline about problems with clothing which they bought. The complaints were up 22 per cent from 2007. Most of them were reporting either they bought a defective garment or they suffered substandard service. Frank Shepherd, spokesman for the helpline, said: ‘Women have complained about many things - clothing shrinking, buttons falling off, seams splitting, colour dyes running and sequins coming off’ (Fisher, 2009).
Figure 4: Properties change after washing (Fisher, 2009)

- Ban on certain ingredients by some countries restricts selling the products that contain the ingredients in those countries thereby affecting the global demand. US Customs and Border Protection secure the homeland by preventing the illegal entry of people as well as goods that are prohibited by the local laws. The items which would injure community health, public safety, workers, children or domestic plant and animal life, or those that would defeat their national interests are prohibited (CBP.gov, 2009).

4.13 Unpredictability in demand:

To meet and decipher the demand from the downstream, companies frequently use forecasting techniques mainly based on statistical model and make order or produce products according to it. But the reality is like that if we use the most sophisticated forecasting models; forecasts are inaccurate and even less positive for predicting low-probability events that has high impacts. This uncertainty has enormously increased in the recent years due to ground-breaking customers expectations, more global competition, longer and more complex supply chains and greater product variety with shorter product life cycle.

IBM experienced this type of demand imbalances during the launching of its laptop computer product line named as ‘ThinkPad’ in two different models T20 and A20 in mid-2000. To predict the expected sales figure, IBM was conservative enough as it lost $ 800 million in 1998 and $ 571 million in 1999 and kicked off a major ad campaign during the release. However, the new Think Pads became an instant hit with customers and sales soared, leading immediately to product shortage. The problem was no quick solution in the hand of IBM as the component suppliers were geared for the original forecast and could not quickly ramp up their production of DVD and CD-RW components. Due to this “under-forecasting” IBM didn’t even know how many potential sales it lost to its competitor. On the other hand, over-estimating demand can also be detrimental as items may have to be sold at discount, robbing the manufacturer or the retailer of its profit margin and even forcing it to sell at a loss. Such discounts are common in both fashion apparel, which is subject to teenagers’ whims, and consumer electronics products, which lose their appeal when a new model or gadget comes on the market. But even in mature products, like automobiles, discounting is common. For example, in 2004 American manufacturers were
offering $3,000–$4,500 rebates on sales of sport-utility vehicles when demand ran below forecast, in part because of high gas prices (Sheffi & Rice, 2005).

4.14 Forecasts’ characteristics

To mitigate this uncertainty in demand, companies are using different forecasting techniques based on dissimilar characteristics and the result is also varied here.

- **Inaccuracy:**

The clearest attribute of all (point) forecasts is that they are invariably wrong as it is simply a statistical reality. For example, forecasting the monthly sales of a certain yellow women’s blouse in size 8 at a given price is bound to be wrong because there is a certain probability that it will equal almost any number. Since the forecast is a single number, the probability of the actual sales matching exactly the forecasted demand is practically nil (Oke & Gopalakrishnan, 2009).

- **Improvement with aggregation:**

A second characteristic is that the aggregate forecasts are more accurate than disaggregate forecasts; for example, forecasts can be aggregated over time, geography, or products. With aggregate forecasts, errors tend to cancel each other out, leading to more accurate forecasts. While it is difficult to forecast the sales of a blue men’s blazer size 42R on a given day in a given store. It is easier to forecast the monthly sales of that blazer in that store, and even easier to forecast the monthly sales of that blazer throughout a particular region (Oke & Gopalakrishnan, 2009).

- **Time Horizon:**

Like weather forecasting, long-range forecasts are less accurate than short-range ones since fewer factors are known due to the longer time frame. Likewise, sales trajectories can diverge further and further from a projected forecast as time progresses. New fashions, economic changes, and competitors’ actions make the distant future more unclear than the near future. But many supply chain operations require long-term demand forecasts since orders involve long lead times.
o **Reliance on history:**

Forecasting methods use historical data and previous experiences. It is difficult to forecast due to scarcity of data when the competitive environment drives manufacturers and suppliers to introduce new products and new versions of old products continuously and when companies enter new markets (*Oke & Gopalakrishnan, 2009*).

o **Reliance on trading partners:**

History, however, is not the only source of data; trading partners often have information that can help in forecasting and planning. For example, retailers can give their suppliers data on sales patterns throughout their stores. So the suppliers can base their forecasts on actual consumer behaviour rather than the retailers’ order pattern.

o **Risk sharing:**

Sharing of data may lead to more accurate forecasting, companies can also share the risks of forecasting. Even though this will not improve the forecast itself, the practice can help supply chain partners mitigate the consequences of wrong forecasts and increase the profits of all trading partners (*Oke & Gopalakrishnan, 2009*).

So, taking into consideration the inherent variability of demand and the limitations of statistical forecasting, company use these characteristics to design their supply chains to be flexible enough to respond to ever-changing demand patterns; thus making them less dependent on demand forecasting. The flexibility to respond to demand fluctuations, created by these supply chain designs, also increases these companies’ resilience to disruption—be it an unexpected demand surge or unexpected problem with their supply lines (*Oke & Gopalakrishnan, 2009*).
5 Case Study
5.1 Case Study 1: Patagonia Inc

Supply chain of Polo Shirt - 100% Organic Cotton of Patagonia

Patagonia Inc is a branded retailer in the clothing and apparel sector based in Ventura, California, U.S.A. In 1972, it was established by the noted environmentalist and climber Yvon Chouinard. The company has a huge assortment of products from T-shirts to shoes, though they are more developed in outdoor segment. The company shows a great commitment to the environmental health connected to social life and as well as to the planet and does it business in best possible ways comparing yesterday implementing same view throughout its whole chain. As a part of their work, Patagonia donates their time, services and at least 1% of its sales to hundreds of grassroots environmental groups all over the world. And the company works always keeping up a slogan “Build the best product, cause no unnecessary harm, use business to inspire and implement solutions to the environmental crises” in their mind (Patagonia, 2010).

The company focuses to be more transparent to its customers and competitors as well through their website by making available some sophisticated information regarding CSR and environmental cost of the products. It has recently introduced a mini-site named as the footprint CHRONICLES to track the impact of specific Patagonia products from design through delivery (Patagonia, 2010).

Products:

Patagonia has developed a versatile collection in its product segment and in their webpage; products are firstly classified as by category, sports & activity and collection. They have clothing items, shoes, luggage & packs and accessories as well and these products are also available for men, women and kids. They have already developed a wide range of organic cotton products and are currently working with recycling of Polyester and Nylon products as well. (Patagonia, 2010)
Supply chain of Polo Shirt:

Based on the interview with Patagonia, we are inferring the following:

Patagonia is working on the organic cotton products way back from eighties. It took a long way for them to find the suitable organic cotton suppliers and garment production units. They are now
quite satisfied with all their suppliers. They are having deep long term relationship with all their suppliers in their supply chain.

They are also not interested in working with the new suppliers. They just want to have very deeper long term relationship with the existing suppliers. They already have good flexibility and understanding with their suppliers. If they approach new suppliers to produce their products, they have to start all the process from the very beginning and the understanding between the new supplier and Patagonia will not attain quickly. Also their relationship with the old suppliers may fade away.

This shows that Patagonia does not treat the business only as trade like just buying and selling, they treat the suppliers as their family members.

To calculate the carbon footprint values, they do not calculate individually for every process of every product. They just average the total energy

First they take total energy spent in a factory per year, from that they calculate total energy spent per year for a particular process of a typical product. Then they do average to find the energy consumption per product. By adding average energy consumption of each and every process of the product, they find the carbon footprint.

During the unexpected rise in demand for their product, they do the production for the shortage only if they have the greige fabric and do some push in the supply chain for the early delivery. Otherwise they do not proceed with the production, since it may affect the employees of their suppliers’ factories by means of unnecessary pressures. It is not right to pressurize the factories for the mistake of sales team and fashion forecasters as it goes against their CSR policy.

This shows that they are not only cautious in the environmental issues; also they are very keen in the social issues.

Even though Cotton is having higher carbon footprint than the man-made fibres or some blend fibres, they prefer to use cotton for their product for its comfort and functionality. People also will not prefer to buy a product only because it is an environmental friendly product. The product should satisfy the needs and wants of the consumers. An environmental friendly product which is
not useful at all is considered as the environmental enemy since it has undergone a lot of operations and taken much energy. So, Patagonia takes care to just make the best cotton products with reduced environmental impacts and not in replacing the cotton.

5.2 Case Study 2: Klättermusen AB

About the company

Klättermusen is a Swedish brand marketing company which was founded by Peter Askulv in 1984. It manufactures outdoor clothing and accessories for customers with high demands on strength and reliability. The company is doing business in 18 countries around the world and its net sales worth is SEK 17 million. The company’s head quarter is situated in Åre and its major markets are Sweden, Germany and Norway. The company is taking greater initiatives in environmental work and it also allotting 1% of its sales amount to the environmental projects. The main environmental projects are rECOver and ECO-index (Klättermusen, 2010).

Products:

Their main products are Jackets and Trousers for men and women, textile accessories, and bags (Klättermusen, 2010).

Eco-index:

The degree of impact on environment of a particular product is expressed by a typical figure named as ECO-index and it is developed by KLÄTTERMUSEN AB by considering ten environmental criteria against which each product is assessed in order to calculate percentage. The percentage actually reveals how far the product is entirely environmentally-friendly and it is in some extent easier for the customers to compare with others as well (Klättermusen, 2010).

Calculation Method:

The ECO-index is based on ten criteria, such as the lifetime of the product, environmental-friendliness of the impregnation and membrane, biodegradability, raw materials like natural non-fossil materials, recyclable in an existing system and so on (Klättermusen, 2010).
Let calculate the ECO-index for the product TJATSE SOFT SHELL JACKET. To calculate the ECO-index of this jacket, Klättermussen has set 4 criteria out of 10 criteria considering its overall properties and the product only fulfils 2 criteria out of 4 here and as single criteria carries 1 point, so the total point is 2 as well (Klättermusen, 2010).

So, the Maximum point is 4 (as the total criteria is 4)

The product’s total point is 2 (as it satisfies maximum 2 criteria)

ECO-index (%) = (2/4) * 100

\[ = 50 \]

So, the result is 50% and it means there is another 50% remaining until it fulfils all the environmental criteria set for it (Klättermusen, 2010).

**RecoVER:**

‘RecoVER’ is an another initiative from Klättermussen AB as a part of its environmental approach towards the planet and under this program the company encourage consumers to bring back its products to the shop and they will get back their deposits worth 1, 5, 10 or 20 Euros mentioned on a typical label. And these returned products are recycled in an environmentally-friendly manner and sometimes donated to charity (Klättermusen, 2010).
Based on the interview with Klättermusen, we are inferring the following:

Similar to the Patagonia’s Polo shirt, Klättermusen’s Einride Jacket supply chain, the material movement is taking place to the different parts of the world. They source Organic cotton fibre from USA, spinning and weaving in Switzerland and sewing in China. The fibre which they use for the jacket is having the long staple fibre. Moreover the yarns should be tightly spun and the fabric contains three different strength of yarn and that also needs to be tightly woven and even.
These require special technologies; as far as their knowledge only two factories in the world have the know-how to do the weaving for them; one in UK and another one in Switzerland.

They cannot simply change the fibre due to environmental issues. If they change the fibre means, the product itself will become different product.

They are using Eco-index for measuring the environmental friendliness of their product. It is a different standard having ten different criteria of evaluation and some of them are not applicable to all products.

The supply chain of Einride Jacket takes six months for production from greige booking till the order in-house. Normally they make extra order than their requirement. So, in case of increase in demand, they cover the lost sales with the surplus stocks of the product.

Technological know-how of the yarn and fabric suppliers is the key player in the supply chain of Einride. Since the technology is not available to rest of the manufactures, Klättermusen has to go for this supply chain in which the material transportation is very huge. And they are also quite comfortable with this supply chain.

6 Results & Discussions

Based on case study we have tried to collect all information against the questionnaires for the companies (see Appendix 1 & 2) and then try to discuss it based on literature review and then finally we come to the results.

From the case study, we have seen that the companies prefer to work in a smooth way and they want to avoid unnecessary risk related to supply chain creating deep understanding among different nodes of the chain. Considering any issue that has not tremendous impact on its supply chain, if they start to alter the supply chain now means, this will take some extra effort for them to make it streamline. They may also lose their credibility to their current suppliers and the transparency of the whole system will also become dubious. The suppliers may start doing some malpractices in order to retain the buyer for their business and ultimately the trust and relationship will lose for the little benefit. So, the companies always try to retain their existing
supply chain even though they have the scope to get the environmental benefits and financial advantage in changing the supply chain.

In general, changing or modification of supply chain involves lot of processes that can be stated below:

i. Analyze the current supply chain in terms of environmental impacts and cost involved.
ii. Find the flaws in the current supply chain like the pollution, non-value added processes,
iii. Try to rectify or reduce the issues in the current supply chain itself.
iv. Find the alternate supply chain in case of unresolved problems.

Where as, companies choose to build up a typical supply chain for a specific product considering several parameters that only fit with its business strategy to enjoy maximum flexibility and comfort as well.

The parameters can be summarized as below:

i. Source from an established market where technology is available and well established enough for a typical product and manufacturing cost is also suitable enough for a company; this is the first considering point for a company during building up a supply chain.
ii. Then they go for mapping out the geographical location, transportation distances, lead time as their secondary agenda.
iii. Thirdly companies who care for environment work with environmental impacts related to products and disruption propensity of its supply chain.

So, when we deeply look into the supply chain and the requirements of the companies, it is not feasible to change the supply chain only because of far away geographical position of the factories and to address the unexpected demand as well. Also it creates problems like lack of transparency in the system, quality issues and unnecessary delays.
6.1 Hypothesis 1:

The companies having scattered supply chain due to its own comfortability and flexibility.

The companies having scattered supply chain have various convincing reasons as mentioned above. Like in case of Einride jacket of Klättermusen AB; fibre from USA, yarn spinning and fabric manufacturing from Switzerland and garment manufacturing from China, they need specific material for their specific product. If we change the materials, then the product itself completely changes.

Moreover, in case of Klättermusen, they do not have many options to choose their suppliers since their requirement are very specific and very special. They need long staple length fibres so that they are sourcing from United States. The spinning and weaving also requires special technologies which already discussed in the result section, so they are going to Switzerland to source the fabric. Our suggestion to Klättermusen is that they can source the fibre from Turkey like Patagonia since Turkey is offering wide variety of organic cotton fibres including long staple length fibres. We can’t suggest any alternate source for yarn spinning and fabric weaving since the technological knowhow is not possible in most of the other sources. Since the jackets production requires some skilled labours, we can’t simply suggest any source. It is also better that they continue with the existing garment manufacturer to produce the Einride Jackets.

And in another case, for Polo shirt, Patagonia is sourcing fibre from Turkey, yarn spinning in one factory in Thailand and knitting and garment manufacturing in another factory in Thailand. It would be better, if all the suppliers were nearer to subsequent processing factory as this would reduce the environmental impacts due to transportation; time and more over save a lot of money. This ideal situation will not possible to all the cases. Patagonia prefer Turkey for Organic cotton because it offers wide variety of long staple length fibres and having the long term relationship with the farmers and it gives some flexibility and comfort in working with them. We cannot simply move the fibre sourcing from Turkey to Thailand or nearer countries in South East Asia. Since, we have not the organic cotton cultivation in those areas and moreover the long staple fibres not produced in those areas. From the interview with Jill Dumain we can understand that they are doing some garment manufacturing from Turkey itself. But they are doing only for some simple knitted products not for the Polo shirt or other products which have little bit more
complexity regarding quality issues and more work intensive. What we suggest is that they can train the existing supplier in Turkey to manufacture their Polo shirt and they can source some other products from their Thailand suppliers and in that case, the fibre, yarn and fabric suppliers will be nearer to that country. This will not affect their policy much and also reduce their transportation time. Since the complete supply chain is geographically located in the same region, it reduces the carbon footprint due to transportation considerably.

![Geographical position of suppliers](image)

*Figure 9: Geographical position of suppliers in the supply chain of Polo shirt (Patagonia, 2010)*

One more reason to be work with existing supply chain is that the labour cost per hour in Turkey is more than the labour cost per hour in Thailand. As per a report on 2003, the labour cost is more by 3 SEK in Turkey than Thailand. May be Patagonia is considering this factor for retaining the same supply chain (Andersson, 2003).
6.2 Hypothesis 2:

*Scattered supply chain has delimited the flexibility of companies to response the unexpected demand and reduced the resiliency of that supply chain as well.*

From the result, it shows that the responses regarding demand fluctuation form the both companies are almost in similar position. Patagonia is showing response to meet unexpected demand from its customers only when it is manageable staying in its existing supply chain strategy. And this is very common and regular strategic plan like to postponement; go for further production from greige fabric and just put extra pushing for earlier delivery connected to strong relationships among different nodes of supply chain. And if nothing to do within its supply chain capacity, just leave the matter and try to adjust it in next new order. In other way, company is relying on its suppliers by means of its close relationships like suppliers will make room for its emergent requirements; the notion of flexibility. Previously in literature review, we have shown supply chain vulnerability can be well managed by creating flexibility in its supply chain and it has also shown that lot of tools are expediting this flexibility and it works based on the level of partnerships among different partners of its chain.

For klättermussen, to manage its unexpected demand surge from its retailers, they are taking safety measures at beforehand. They are using very ordinary formula like add some extra quantity to its regular order; it is the notion of redundancy in supply chain to manage the disruptive situation and always maintain a good relation with upstream and downstream as well. Redundancy is also a quite good weapon to manage vulnerabilities in a certain scale that we have seen in literature review section.

Both the companies are strongly focused on quality issues in their supply chain and committed to offer best possible product to their customers, it is a perfect strategy to tackle demand drop due to losing customer confidence on a specific brand.

Though there are several options to tackle the unpredicted demand like adding a new supplier in a supply chain, switch to nearby production, building in-house production facility but due to the product’s special characteristics, availability of manufacturing technology and price strategy,
companies are bound to work with a scattered supply chain limiting other issues that connected to resiliency of that supply chain.

6.3 **Inter-relationship between sustainability from ecological point of view and Resiliency in supply chain during demand fluctuations:**

In order to be a supply chain continuously sustainable from ecological point of view, it should be flexible enough during increase and decrease of the consumers demand; the supply chain should also be resilient as well.

In normal situation, consistency in demand from the customers is mostly dependant on the customer’s confidence or trust on a particular product. Today’s customers are more conscious about environmental issues and they also want to know the environmental cost of the product. To address the sustainability issue from environmental perspective, companies are working on carbon footprint, eco-index, and product rating system and so on to measure the environmental cost of a particular product.

When we discuss about the environmental sustainability of a supply chain we are aware that the environmental catastrophes has tremendous impacts on resiliency of the supply chain. Resiliency of a supply chain is more vulnerable to the environmental disaster and in this case, control over the supply chain from all actors of the chain is nearly zero. Companies experience demand fluctuations due to their wrong forecasting. If it is over forecasting in regard to actual demand, at first it will cripple the company financially due to increased inventory cost and lead to reduce the pricing to remove the product from stock. If the products are not finally sold, they will be discarded and this over production costs the environment and also the energy that was used during manufacturing and transportation goes in waste. This ultimately troubles the resiliency power of the company and in addition destroying the ecological balance of the environmental sustainability.
So when there is unexpected increase in the demand for the product, the normal/current supply chain may not produce enough products to cope-up with the demand. The supply chain needs to be altered in such a way that the supply chain should be flexible enough to fulfil the demand without increasing the environmental impact. In our case, the carbon footprint should not increase while changing/altering the supply chain.

6.4 Research Limitations:

- Time duration for doing the thesis
- We didn’t get the immediate response from Patagonia, so we don’t have time to ask further questions which rose during discussion, since the submission date is very nearer.
- The questions which we prepared are for different research question, but based on the answers which we received we couldn’t continue with finding answer for the original questions. We framed the questions based on the interview response.
- We don’t have sufficient information from both the companies to strongly support our hypothesis

6.5 Recommendation of Future Research:

- Develop and suggest an alternate supply chain for the case study companies with reduced carbon footprint
- Find the technology know how in the yarn spinning and fabric weaving for the Enride jacket of Klättermusen and try to source a better alternate suppliers
- Deep studies in environmental impacts and money involved in having the scattered supply chain.
- Possible ways to tackle the demand fluctuations
- Finding various combinations of the supply chain suitable for the western buyers in terms of reduced environmental impacts considering the quality and cost.

7 Conclusion

In our research, we have tried to figure out some embryonic reasons for which the companies prefer to work with a scattered supply chain knowing its possible negative impacts regarding to environment and disruptions as well. After analysing the case study we have got an idea that companies have to choose this kind of supply chain considering the technology availability that involved with the products and then obviously price issue. And they believe to adjust everything possible to achieve sustainable and resilient approach staying within its existing supply chain not altering it by the force of relationships. Moreover it is also clear to us that companies are more focused to work with environmental friendly raw materials to attain ecological sustainable approach rather than processes and transportation involved with it. Here the both case study companies have the same view as stated above and they are reluctant to do any adjustment in their supply chain as it will cost their time, money and also risks will be increased. But our suggestions to the big companies are to do some adjustments among their different product’s supply chain that belongs to same or nearby location to each other on an experimental basis and try to provide logistics and technological support to develop its new suppliers as because in the long run, this strategy will reduce the total environmental impact and will help the company to attain more flexibility to address the demand fluctuation of the products in the supply chain and this will be time and cost effective also to the company.
8 REFERENCES


Mattila, H. (n.d.). *Fashion Logistics and Brand Management*


9 Appendix
9.1 Interview with Patagonia Inc

Edited version of interview with Jil Dumain, Director of Environmental Analysis, Patagonia Inc.

Questions are related to the supply chain of Polo Shirt - 100% Organic Cotton of Patagonia

1. **What are the reasons behind sourcing fibre from Turkey (not for example the USA) and then transporting it to Thailand for spinning, knitting, cutting, and sewing?**

Five years ago there were no companies who came up for discussion about issues. The companies would not reveal the information about how much energy they were using for the production. The younger generations want to know more about their stuffs. I think Europe is headed in consumer side than United States.

All come from the product definition. In the early days of organic cotton, we went and found the organic cotton project. We didn’t know who was growing the cotton and who was manufacturing. There was no internet and there was no email during that time. We had to send faxes, out to people in China and wherever. I found my ways to track the people down. Turkey was growing organic cotton in a pretty big way from the beginning as size as the United States. But this is where the business pressure comes in. So, what type of fibre you are choosing for the yarn or fabric that comes in the price point and your spinning mill has a business for getting the fibre to them. Some of our supply chain started very very early on organic cotton industry.

Are the supplies meeting the price and are they meeting the quality? We don’t tend to switch a lot. US were decreasing the cotton production but Turkey was increasing the cotton production. We also have the ability to have the broader range that we chose from.

The polo shirt, we started as Rugby shirt in US with organic cotton. The business in US is different compare to Asia. In Asia they were already moving, 20 years ago it was full packaged deal, and they would find all your trims. If you think about polo shirt, you have the knitted collar and knitted piece on the sleeve sometimes. They have to be matched and they have to be dyed together. Knitting mills in the US weren’t willing to do all the pieces.
So we had to go and find the fabrics, find the collar, try to get them matched, try to get them fade evenly. So as the garment is worn as this dark blue cuff in a light blue shirt something like that. So I guess I’m giving lot of reasons why? But at the end of the day it backs to the balancing the environmental impact which would give us a business and the quality of our product. So we often choose the factories that build the product first, to the quality stamping and try to filling the where is the fabric coming from, where the best yarn coming from. Cotton is the very very global business.

Sometimes we have found with our environmental work, you can make changes in some places, but it is good to follow where business has developed in other places. So, for example, if we try to find a knitting mill close to a cotton source in the USA, because we could be closed by the locally and on environmental. We probably can compromise our quality, in this lot of time in business, its luxury of time to develop what it would take couple of year’s time to develop the supply chain. It is not easy to move the supply chain. So, as our organic cotton developed, we developed the deep supply chain accordingly. Turkey had done a lot of production there and also their fibre there. There are beautiful beautiful fibre out of turkey, it is long staple and lot of it is handpicked and it preserves the quality of the fibre and might be the US it mechanically picked all, You can get a cheaper type of fibre in Turkey like APALANA compared to the PIMA in US but you preserve the long fibre length. So those are the some considerations that we go into and any is but price is on top of it all. That’s the real reality that we are dealing.

We did simultaneously lot of product in Knit in Turkey as well. In our experience, Thailand is better for more complicated products and Turkey is better for more simple styles. We could do some of our yoga line and t-shirts in Turkey but if there is placket in woven / non-woven facing and collar, and then Thailand is doing a better job for us. We have started bringing mixed fibres, we have bringing them for performance, we have double knits. We have polyester in inner for wicking and performance and cotton on the other side, so looks like a normal t-shirt. Thailand has more technology available to them and the time as well.

2. How do you calculate the carbon footprint—what kind of formula do you use? For example, how much carbon footprint involved in:
a. Fibre transportation from Izmur, Turkey to Bangkok, Thailand  
b. Transportation in Thailand for knitting  
c. Finished goods transportation from Bangkok, Thailand to the Distribution centre in Nevada, U.S.A.

We take the energy require in each section from fibre production to the transportation of complete garments to the distribution centre in the supply chain for one year and convert them to the average garment, as there is no specific machine to measure it individually.

3. How do you respond to an unpredicted demand for a product? Vice versa, how do you respond to lack of demand for a product?

We try to do ‘chase products’ and if the mill is on the position on greige goods, over that extra dyed finished goods. Which is not the case, then we might be able to chase goods with in a time frame that we needed. If we can’t, then we just missed out of the sale. We order much more on the next year in time.

That will actually bring potentially to very big issue around on social issues and labour issues. Because as we tried to chase, the pressure is put up on the factories, so because the sales window that needs to be met in there. In the chronicle website, in the digging deeper section there is a new video that uploaded few weeks ago on quality. It is the third one, if you go into that section and there is really great little segment in that. A man speaking about this very topic where it is very easy to see the story that the workers were exploited by over time. You really be mad as the factory manager is forcing his workers to do that. In fact, it is very well the designers fault; sitting in San Francisco or Santa Barbara that made a last minute change and just shifted all the casuals in the supply chain and the end pressure is on the factory manager.

4. Do you work to develop new suppliers to make your supply chain more flexible?

We have couple of challenges. One is very very specific about what we want that our supplier do and it takes a long time that a supplier do up to a level to our satisfaction and we are often making a specialized product again from our earlier conversation. Going back
to the raw material, we have not so much luxury to switch very easily. In addition to it, our quantities are not that large. We often don’t need to worry about factory, about their capacity because they have one year capacity for us. We don’t have larger programs to split into more than one factory because our quantities aren’t huge. We actually on a consolidation track right now over suppliers like from sixty to sixty five or sixty seven and they are working very hard to consolidate. And we have enough flexibility built in all the different kinds of products that we are making but still keep really tight and try to reduce it so that we can have the deeper longer relationship with them.

5. *You know all your organic cotton products have a higher carbon footprint than the man-made or blended fibres; do you have any plan to work on it to reduce the carbon footprint of organic cottons and how?*

*What about recycling of organic cotton products like you are doing for polyester garments?*

Though cotton is having higher carbon footprint, consumers prefer it over the polyester for its comfort property. We have to give the product to the consumer what they need or want and not to the fancy level. Non usable sustainable product is having more environmental harm than the usable product which is having more carbon footprint.

We just think how we would make the best cotton products that we can, because that’s the people going to use.

If you consider the environmental impact of virgin polyester product and recycled polyester product in terms of carbon footprint, the result is far from each other. But if you consider the durability, for virgin polyester it is 10-15 years, where the durability of recycled polyester would be only 2 years. In this case virgin polyester is more preferred over the recycled polyester.

6. *Are you working on any special fibre innovations that you can tell us about?*

I feel to develop such kind of tool and to set up in design studio and in a mill where the product is designed and manufactured where it will go through environmental way and it's something passive.
7. What is the lead time for the production of the Polo shirt? Do you begin with grey goods or before that?

For the polo shirt, how many suppliers do you work with for fibre production in Turkey, yarn and garment production in Thailand?

In general, do you have any special "Patagonia-only" challenges ensuring on-time delivery of your products?

Are there any special technologies involved in making this product? For example, we have talked with Klättermusen about a product whose fabric can only be produced in Switzerland.

Lead times for the sourcing of Polo shirt are as follows:

- Fabric: 73 days
- Production: 59 days
- Transportation (ocean): 30 days
- Total: 162 days

9.2 Interview with Klättermusen AB

Edited version of Telephonic Interview with Peter Askulv, President, Klättermusen AB.

Questions are related to the supply chain of Men’s Jacket (EINRIDE 100% Organic Cotton) of Klättermusen.

1. Could you describe the supply chain (Fibre production to Distribution centre) for the above product?

Fibre from USA, Yarn and fabric with colouring and finishing from Switzerland, Garment is from China.

Only one yarn supplier, only one fabric supplier,

Only one garment supplier for this product.
2. **You are using Eco-Index for your product and actually what does it mean and what are parameters of your evaluation? Do you measure the environmental impact of a product in terms of carbon footprint?**

It is very simple. When we do in eco-index, we can go into deeper. But, it’s only simple. We do it this way, that we have 10 different criteria of evaluation. Some of them are not applicable to all products. In this case, the Enride jacket get 1 for being made of ecological cotton. Gets 1 for fluorocarbon free impregnation, 1 for bio-degradable material and so on.

[NOTE: The above product satisfies 6 criteria out of 7 criteria set by Klättermusen AB and each criteria carries 1 point, so the ecoINDEX for EINRIIDE 100% Organic Cotton Jacket is 86% (6/7)

- Fluorocarbon free DWR • PFOA free DWR • Natural material or non fossil carbon source, more than 70%
- Organic certified material • Biodegradable, more than 70% • 1% to the environment projects (6/7) *(Klättermusen, 2010)*

a. **DWR**- Double Water Repellent

b. **PFOA**- Perfluorooctanoic acid (PFOA, Molecular formula - \(C_8HF_{15}O_2\)), also known as "C8," is a synthetic chemical that does not occur naturally in the environment. It has special properties that have many important manufacturing and industrial applications.

EPA (Environmental Protection Agency) has been investigating PFOA because it:

- Is very persistent in the environment
- Is found at very low levels both in the environment and in the blood of the general U.S. population
- Remains in people for a very long time
- Causes developmental and other adverse effects in laboratory animals *(Epa.gov, 2010)*

We don’t calculate the carbon footprint.
3. Are you working with the recycling of organic cotton products? If yes, how and where are you doing and what is the recycled product?

No, we are not working with the recycling of organic cotton. We are planning to set that up. We are discussing and that is the final goal that we do that.

4. You know all your organic cotton products have a high impact on carbon footprint comparing to the man-made or blend fibres; do you have any plan to work on it to reduce the carbon footprint of organic cottons and how?

Yes, when we calculate the carbon footprint of Cotton and Polyester, Polyester is better than the Cotton in terms of environmental friendly. In our strategy, we do both ways. We do recycle polyester fabrics and we do cotton fabrics and the final destination has to be made by the end customer. We do the best possible product in every segment. It is not possible to make Eniride Jacket completely in recycle polyester, and then it would be a different product.

5. What is the lead time for the bulk production of this Jacket?

Lead time is 6 months. Lead time is calculated from Greige weave to final product. We normally make a forecast that the weaver always booking some greige material above we place the final order to do the dyeing and finishing and send it out.

6. How many suppliers are working with fibre production, Yarn production and Garment production for the above product?

(Answers are in the first question)

7. How do you work with your supply chain in critical situations like fluctuations in demand from your customers?

We work like this, we sale mainly to retailers. We bring the order from them, we have a tolerance. We forward it back to sale order. It is order demand function production system.
We get big orders for the production. It is not problem for us to increase. We normally order 20% percent more than the actual order which we received.

8. What is the strength of your supply chain?

I don’t know the advantage, but we started like this and now it works well. We have no problem with it.

9. Why do you want to source fibre from only place, spinning and weaving in another country and sewing in China? Why don’t have them in China itself?

In an ideal situation we should have close production, like spinning, weaving and sewing in the same place because we save a lot in transport. But the world is organized either, not quite possible. It could be possible to move some of weaving to other place. But the problem is we are buying the extremely densely woven cotton which only 2 factories in the world that can do it. We actually tried with some Asian factories but they are not able to do this product.

10. Why are you so particular about this kind of yarn? Why can’t you change the yarn?

It is because the yarn is made up of extremely long staple fibres and the weaving is very very tight. It is difficult production. The fabric is made up of yarns of three different strengths and they should extremely even. It is typically difficult production and especially the weaving part. Only two factories can able to make it, one in UK and another one in Switzerland; so far I know because I’m very particular about this. Probably the weaving is quite possible in some other factories as well.

11. What are the main focuses in your supply chain to ensure the on-time flow of the products?

Our focus is of-course quality & checking and environmental issues. In this product we are working with organic cotton, carbon free impregnation, weaving and dyeing process as well. In other products we are working with recycling.