



Master's degree thesis

LOG950 Logistics

“The impact of sustainable procurement and its effectiveness in an aim to reduce environmental externalities on the context of during and post COVID 19 Pandemic: A comprehensive study on Ready-made Garments industry in Bangladesh”.

Author:

Mohammad Sazzad Hossain

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Preface

This master thesis marks the finishing line of master's degree in Logistics at Molde University College – Specialized University in Logistics. Within the two and a half years of my study in Molde University, I have had one of my best experiences in education - a great learning environment and academically stimulating programs in a diverse platform. I would therefore, like to express my gratitude to the authorities and staff of Molde University College, for the opportunity of learning in a wonderful atmosphere.

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If I rewind back this journey would not been possible without all the support of them.

Last but not the least I would like to conclude by this sentence “We cannot leave this planet, Lets work together to make it habitable for us” .

Mohammad Sazzad Hossain, November 2021

Abstract

To reduce the risk and impact of climate change, extreme heat, droughts, floods, and other natural disasters, unprecedented action is required to confront industrial pollution. The readymade garments (RMG) industry in Bangladesh is one of the most important catalysts for the country's economic and social development. In response to the impact of COVID-19, the apparel industry has been faced with an unprecedented phenomenon. Because the supply chain has been significantly impacted, there is growing concern among industry stakeholders and policymakers about how to prepare for and respond to disruptions caused by pandemic to aim sustainability. This study aims to investigate the impact of sustainable procurement in the ready-made garments sector in Bangladesh, as well the relationship between these drivers and supply chain resilience. As a result, the author decided to investigate how digitalization can improve the information flow of materials in the SC, thereby enabling circular production and traceability of raw materials to be implemented. Specifically, three research questions were developed and answered through a general case study in the Ready made Garments industry in order to assist in determining how to solve the problem. Semi-structured case company interviews were used in this case study, which was carried out as part of an exploratory research project. The literature on the overview of the ready-made industry, supply chain mapping of the apparel industry, sustainable procurement and 3BL paradigms, SC resilience, the substantial need for certification to implement sustainability, and the adoption of blockchain technology in the apparel industry will comprise the theoretical portion of the course. A two-part analysis was conducted in which the author attempted to determine how selected case study companies are incorporating 3R (reduce, reuse, recycle) practices into their business model in order to fulfill their sustainable brand promise, and later the author attempted to determine possible answers to the research question, such as how SC resilience contributes to social and environmental sustainability efforts, among other things. For example, how digitalization in the apparel industry, such as Blockchain, can be implemented to achieve sustainable paradigms and so forth

Keywords: Sustainable Procurement;3BL; Social; Environmental; Economic; Circular 3R-(Reduce,Reuse,Recycle),Value for money, Supply chain Disruption, Supply chain Resilience, Digitalization, Certification, Blockchain.

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1.0 Introduction

1.1 Chapter introduction

This chapter contextualises the thesis subject, highlights the existence research gap regarding the practical approach concerning sustainable procurement and to what extent it can contribute to make an impact in the context of emerging COVID 19 situations. This research is on sustainable procurement which is a clarion call specifically in the Readymade garments industry in an aim to lower the environmental pollution. The study interest is to examine how the sector may meet its global demand for goods and service in a sustainable way by adoption of 3R strategy (Reduce,Reuse,Recycle).

Further, research objectives are described, and the research questions applied to examine the subject presented. In addition, there will be a thorough explanation to why this area of interest is abundant for explaining the realistic attempt to emphasize on sustainable and circular procurement that can help industry stakeholders by adopting innovative technology which may benefit the Ready-made garments (RMG) sector and society in a long run.

1.2 Background of the study (Research Motivation)

The readymade garments has become a volatile industry considering prices and supply chain risks, which is why the demand for materials and consisting product modification and even international factors like the economic instability are the kind of challenges that the manufacturers and retailers facing now a days(Wong,2006). Corporations use supply chain management to produce top-notch products and keep customers satisfied in the competitive market. The clothing business has multiple supply chains of events that start with the sourcing of raw materials such as fabrics, then move on to the manufacturing process, quality control, warehouse and logistics, and finally the distribution of the products to the end consumer(Bag,2020). Procurement is one of the areas that businesses may leverage in their manufacturing process to improve product quality, lower costs, reduce lead times, and make them more competitive in the global market (Isen,2012).This research is enclosed of a broader study of social, environmental and economical reporting and operating practices of procurement and manufacturing of Ready-made garments industry in Bangladesh.

The production of Cotton consumes the lions's share of water, from seed to factory followed by textile operations such as bleaching, dyeing, printing, and finishing (Amutha,2017). The garment industry

accounts for 20% of industrial water contamination, with 85% of it attributable to dyeing operations (Periyasamy,2017). Global textile industry uses roughly 44 trillion liters of water yearly, or 3% of global irrigation, largely for cotton production (Schrott,2015)



Figure 1 Water consumption to produce one denim and a T shirt. Source :(Pal,2017)

As the apparel industry is enormous in terms of maximizing the use of production resources, there are significant environmental problems that need to be aware of. According to Niinimäki, 2020, Only in United States, more than 520 million pairs of jeans are traded each year (Zambrano,2021). Many have been dyed, acid washed, sandblasted and chemically treated to get the old, worn-in aesthetic that we all crave. There are 2.4 percent of the world's farmland dedicated to cotton crops, and denim's life cycle begins with the cotton boll (Thomas,2019). A small piece of clothing requires a massive amount of water to make. Oxfam has highlighted this issue (Fig 1). To make only one T-shirt and one pair of jeans, the water required to grow and dye the cotton is estimated to be around 20,000 gallons (Pal,2017). It is necessary to make proper use of deadly organophosphates, which end up in the soil and end up wreaking havoc on the local animals. Fibers of cotton are combed into yarn and denim yarn is scaled with starch and "mercerized" with caustic soda to give it strength (Browne,2005). In rivers, starch is biodegradable, but the microorganisms that devour it also deplete rivers of oxygen. Toxic caustic soda also contributes to the demise of aquatic life in the affected area. To make one pair of jeans, 1.5 lbs. of cotton requires 1,500 liters water, which is an alarming number (Claudio,2007). Denim is submerged in containers of synthetic

indigo to achieve the desired shade of blue. Denim can be stone washed or distressed by repeatedly washing and rinsing and bleaching, chemical blasting with harmful compounds such as silica, dye stripped, or bleached with potassium permanganate, apart from the initial dyeing. Clothing purchases have environmental implications that most people are unaware of. Everything from the manufacturing of fibers to the disposal of clothes can have a destructive influence on the ecosystem during the product life cycle (Crewe,2004). As long as fast fashion continues ignoring sustainability aspects, environmental degradation will also continue as well.

1.3.1 Research Gap

The procurement process is substantial because the company's procurement of goods and services can typically account for 50-70% of total costs and in some cases as much as 70-80%, depending on the industry (Pereira,2014). There has been some research at the sustainable procurement practices in Ready-made garments industry before COVID 19 outbreak. When it comes to complex global production methods and value chains, the pandemic and containment measures have prompted fresh concerns about their systemic resilience, prompting increasing interest in diversified and more locally based production methods and shortening supply chains in particular industry (Ferreira,2021).

The COVID-19 situation creates a space for developing a flexible and resilient manufacturing system to maintaining the economic and social sustainability of the production process. The firm's supply chain network resilience is required to confront the epidemic (Villena,2019). This study will pave the way for further research into how sustainable procurement can open a new door to think for business transition that can be applied to support the economic and social development. Conventional methods of dealing with issues of waste, sustainability, and resource efficiencies have not addressed continuous and rising consumption levels nor have developed an overall vision to achieve sustainability (Baily,2008). Circular economy can bridge the gap created by natural resource scarcity and rising global population or demand by encouraging the development of closed-loop manufacturing practices. To overcome this, we need to rethink manufacturing and consumption processes, and build mechanisms for manufacturers to share ideas to implement in the industry.

1.3.2 Research objective

The fast fashion industry is one of the most contaminating industry in the world, having a long supply chain that has significant environmental and social consequences (Claudio,2007). An important contributor to long-term industrial development is the green industry effort, which is taking place around

the world. Bangladesh's economy has set a goal of reaching middle-income status by 2030, and in order to attain this goal, sustainable development must be implemented throughout the supply chain, with the green industry serving as one of the key drivers (Naher,2018). During the past 30 years, environmental deterioration has been seen as a serious concern in the industrial sector(Breuer,2019). Bangladesh is moving in the direction of these policies and implementing environmentally friendly practices in several businesses, particularly in the garment industry (Miah,2010). The increase in greenhouse gas emissions caused by industrial operations, as well as the depletion of natural resources, has resulted in a substantial environmental challenge. According to the Environmental Performance Index 2018 report, Bangladesh is placed 179th out of 180 nations in terms of environmental performance (Table 3). As a developing country in the modern era of globalization and with hopes to achieve middle-income status, Bangladesh has been working hard to modernize its industrial infrastructure. The rapid rise of these businesses has contributed to the country's socioeconomic development by creating a large number of job opportunities, reducing poverty, and improving the overall standard of life (Rahman,2017). As the globe grapples with an environmental catastrophe that has ramifications across a wide range of issues, economic progress must be achieved in such a way that environmental considerations are given top priority in order to be sustainable over the long term. Industries are implementing regulations that make every effort to achieve the aim of long-term sustainability.

To create knowledge and insight in Ready made garments industry the objective of the study is as follows:

- (1)How fashion industry can be more sustainable in production and post consumption to reinforce the supply chain network ?
- (2)How we can design the whole Apparel SC that can be more transparent to end consumer to achieve sustainability paradigm ?

1.3.3 Aim of the study

The aim of this study is to identify the factors that can aid in the transition from a linear to a circular economy in the textile and apparel sector in Bangladesh, which is also linked to the following factors:.

- (1) To understand the circular economy ecosystem that can be applied to the textile and apparel sector.
- (2) To create trust and enhance transparency between manufacturer to end customer to create value chain in the SC networks by digitalization.
- (3) To understand the potential benefit of blockchain technology in the textile and apparel circular economy ecosystem.

1.3.4 Research Questions

i) How can supply chain resilience contribute to social and environmental sustainability efforts during and Post Covid 19 Pandemic?

The capacity to adjust to climate change is one component of increasing overall economic and social resilience (Morecroft,2012). Investing in infrastructure networks will be increasingly as a result of climate change, but these investments will also contribute to society's overall resilience. It is vibrant to confirm that supply chain infrastructure investments are climate resilient and do not increase exposure and vulnerability (D'Orazio, 2021).Because it will help us understand how resilience might reduce direct economic damages from climate or human related disasters while also minimizing the indirect costs created by cascade effects caused by disruption of both key services and economic activity.

ii) How can digitalization and innovation contribute to improving sustainability of Ready-made garments industry?

This is an important question because how innovation that builds on transparent technological process that will be critical to achieve climate and other sustainability goals. It will benefit us to understand how technology can help us to select sustainable supplier through digital certification, How blockchain can validate to choose production material that can be reused for future consumption. It will also help the end customer to understand how digitalization can help to create brand awareness and encourage sustainable buying behaviour.

iii) What are the driving factors that can facilitate to achieve sustainability in the context of the Ready-made Garments industry?

Procurement has always been seen as a support function for other departments (Bienhaus,2018). When it comes to achieving sustainability, there are many complex procurement procedures that are tightly interwoven, and procurement managers must prepare themselves and elaborate on the methodical work in conjunction with other aspects to achieve sustainable procurement in their organization.

1.4 Chapter summary and structure of the thesis

This thesis consists of seven chapters.

Chapter 1 presents a brief introduction, describe the Background and motivation of the study, research gap objectives of the study and ended with Research question.

Chapter 2 starts with a brief overview of the Ready-made garments industry in Bangladesh. The discussions here cover issues relating economic role of garments sector in the development of countries economy through employment and export destinations and ended up with a strongly expressed demand for looking at environmental impact.

Chapter 3 is the literature review which will go through background literature on the triple bottom line (TBL).Further The chapter contains literatures on the significance of 3R -Circular economy (Reduce, Reuse and recycle) in the whole supply chain of apparel industry as the main concept of this research. First, the general principles and dimensions of the TBL are outlined and discussed. Then the individual elements of the TBL framework are discussed. The chapter goes on to further discuss procurement within the concept of the triple bottom line literature, Leagile, transaction cost theory. This leads to the discussions of supply chain resilience during covid 19 and Later discussion on innovative technology such as blockchain that may meet the challenge of sustainability in fashion industry.

Chapter 4 discusses the research methodology and the research method used in the theses and the explanations or justification for the choices made.

Chapter 5 presents the Profile of the case study companies background, subsequent analysis of their production, supply chain and understand how companies can adopt 3R-(Reduce,Reuse,Recycle) in their procurement framework to keep their sustainability brand promise to make an impact on sustainability paradigm(Economic, Social and environmental).

Chapter 6 is the discussion section of the study and gives the researcher's interpretation of the research findings. The interpretation of the research findings is then compared with existing literature, as presented in chapter 3, to check out for similarities or conflicts with the existing literature.

Chapter 7 is the concluding chapter of the study and contains the summary and conclusion of the research, research limitations, and further research recommendations.

2.1 Context :About Bangladesh

Bangladesh, a country in southern Asia bordered by India and Myanmar, with a population of around 165 million people (Anwar,2020). The Ready-made garments sector is widely regarded as the economic backbone of Bangladesh (Raihan,2002). It accounts for around 84 percent of total exports (Rahman,2015). Over the last six years, the Bangladesh economy has risen at an average rate of 6% per year, accounting for about 12% of GDP in 2018 and 2019, and this Garments industry employs approximately four million people (Mazumder,2015). Bangladesh's export-oriented garment manufacturing business has grown to a \$34 billion-a-year industry (Hossain,2016). Bangladesh's textile and garment manufacturing industries are propelled forward by a young, urbanizing workforce, the majority of whom are women. With the majority of manufacturing heading for the United States and Europe, Bangladesh's ready-made garment industry currently accounts for roughly 78% of total exports, placing it second only to China as the world's largest apparel exporter (Ahamed,2013). Young entrepreneurs are involved in a variety of small and medium-scale garment industries that produce standard items. As a result, this substantial segment of the sector demands economic and sustainable development. Bangladesh, which Henry Kissinger (1923–2009) originally referred to as a "no-limit container," has evolved into a "rapid developing nation." (Shamsuddin, 1998). The great benefit of international purchasers from Europe, the United States, and emerging markets will accelerate it in the future days (Ahmad,1990). As a result, it is substantial to improve the sustainability of this sector by procuring and supplying superior quality products globally.

2.2 Overview of Ready made Garments Industry in Bangladesh

Garment industry is operated by the transfer of production because this is a labour-intensive industry(Muhammad,2011). The giant corporations have transferred their blue-collar production activities from high-wage areas to low-cost manufacturing regions in industrialising countries (Arnold,2011).



Fig 2 :Globally Minimum Monthly wages in Garments Worker. Source :(Scott,2006)

The present production shift reveals that the tendency of Cheap labour wage is the key reason for the transfer of garment manufacturing in Bangladesh (Fig 2). Any brand with the 'Made in Bangladesh' tag, is considered as a high valued brand across the world (Saxena,2014).

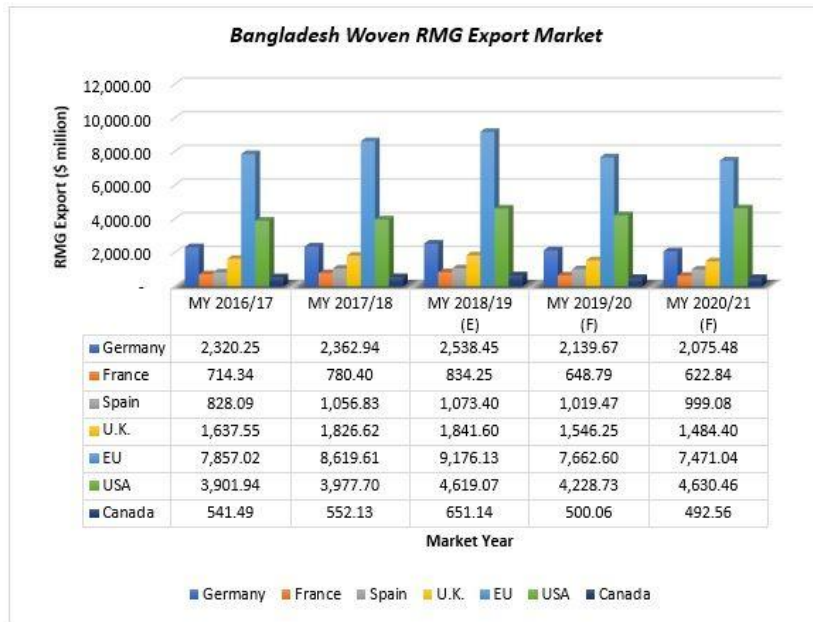


Figure 3 Bangladesh woven export in years ,by countries,Source Bangladesh Garments exporters manufacturer association(BGEMA,2018)

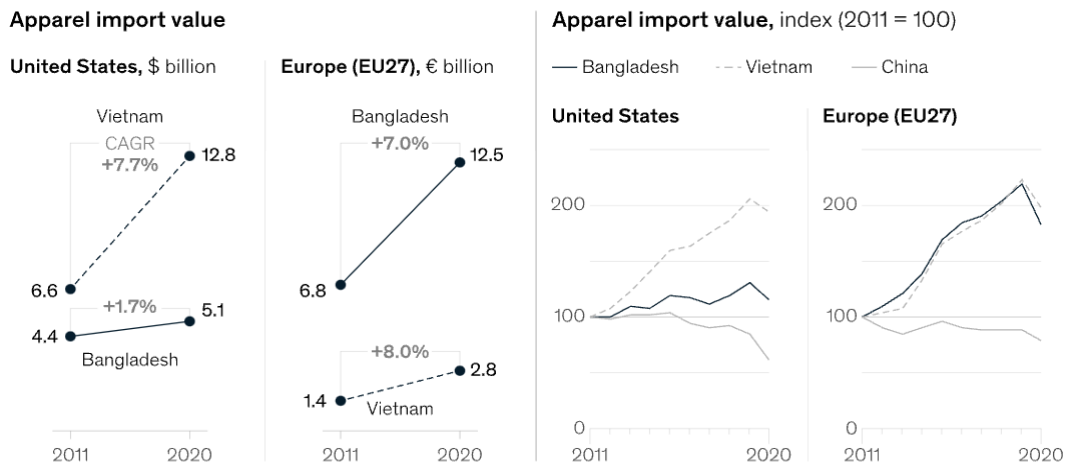


Figure 4: Top Growth Countries in apparel import, 2020.Source : (Ahsan,2021)

Bangladesh's Ready Made Garments business began in the late 1970s, grew rapidly in the 1980s, and exploded in the 1990s. However, Bangladesh's RMG sector has maintained its position as a major exporter to Europe's fashion industry over the past decade, and its market share has expanded significantly (Fig 3).

Over 5,000 Bangladeshi items have been granted duty-free entry to China by the Chinese government in the early fiscal year of the 2019 fiscal year, according to the Export Promotion Bureau (EPB) (Zambrano,2021). International brands like Zara and H&M boosted Bangladeshi clothing exports to India. There has also been an increase in the number of fashion-conscious consumers in India. Textile raw materials including cotton and machinery are imported from India to Bangladesh for use in the garment industry. Chinese exports also experienced a decline in growth (Fig 4). Garment exports from Bangladesh were buoyed by the US-China trade war (Rahaman,2021). Due to the surge in tariffs imposed by the United States, Chinese manufacturers have begun transferring their business to other locations (Mao,2020). In order to compete in this highly competitive market, international merchants have relocated to Bangladesh, which offers high-quality products at comparatively cheap prices.

2.2.1 Development of Garments factories over the year

The cornerstone of the textile industry was laid down in the nineteenth century, while the garment industry had its start in 1978 with the very first RMG factory, Reaz Garments, which sent its first shipment to the United States, which was Mercury shirts (Ahamed,2013). The following (Figure 5) depicts an overview of the development of garment manufacturing in Bangladesh. Some hardworking entrepreneurs established their RMG businesses in the country by following in the footsteps of the early adopters in the RMG sector, which is remarkable. From there, the RMG sector in Bangladesh was growing at a rapid pace and there was no reason to turn back.

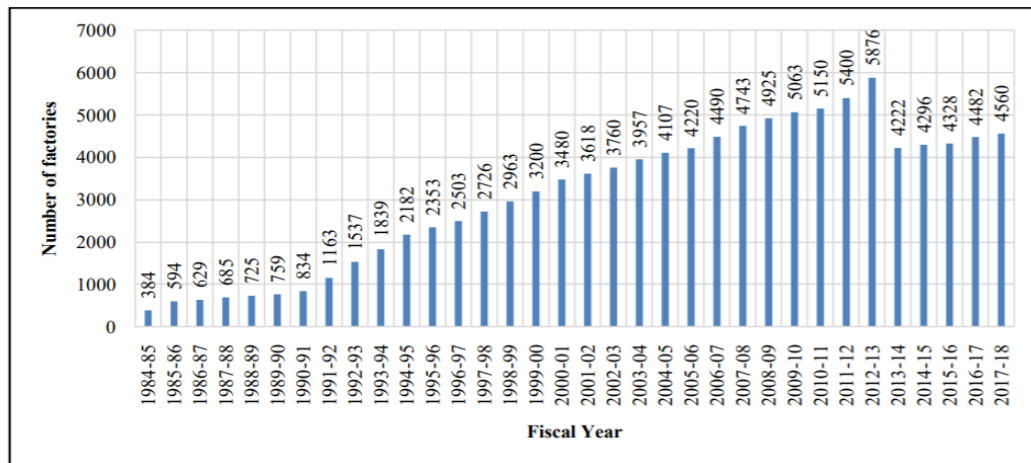


Figure 5. Number of garment factories in Bangladesh. Source : (Kabir,2021)

2.2.2 Employment opportunity created by the apparel sector

From the Start Bangladesh's ready-made garment sector is about to embark on a significant new chapter in its history. The growth of the RMG industry is regarded as one of the best developments in the Bangladesh economy, as it created enormous employment opportunities in the country, particularly for women (Aziz,2017). The industry has the potential to become the world's premier garment manufacturing center, delivering high-quality, fairly compensated jobs to millions of people employed in the country's vital industry. The Garments segment employs more than 4 million people (Hossain,2020). The following table 1 details the inclines of laborers in the Readymade Garments industry.

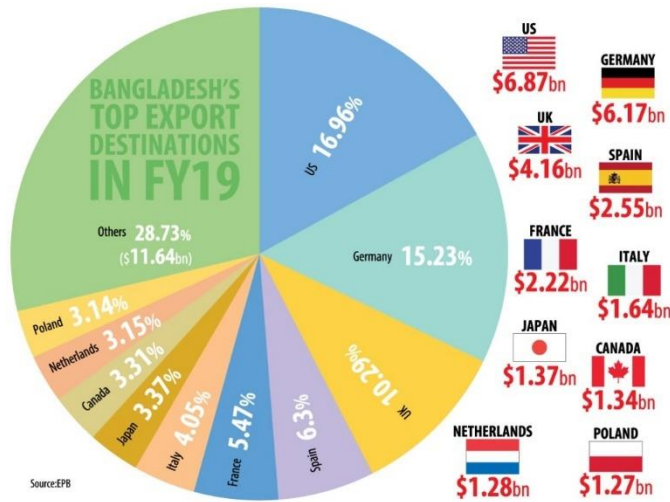
Year	Number of garment factories	Employment in million workers	Export of RMG (In Million US\$)	Main apparel items T-shirt exported from Bangladesh (Value in MN. US\$)
2007-08	4743	2.8	10699.8	2765.56
2008-09	4925	3.5	12347.77	3065.86
2009-10	5063	3.6	12496.72	3145.52
2010-11	5150	3.6	17914.46	4696.57
2011-12	5400	4	19089.73	4713.11
2012-13	5876	4	21515.73	5143.22
2013-14	4222	4	24491.88	5863.81
2014-15	4296	4	25491.4	6064.13
2015-16	4328	4	28094.16	6118.53
2016-17	4482	4	28149.84	5861.98

Data Source Export Promotion Bureau Compiled by BGMEA

Table 1: Growth of Employment in Ready-made garments industry. Source: (Islam,2021)

2.2.3 Export destination of garments items

The ten biggest nations (Pie chart 1) imported about 71 percent or \$28.89 billion of Bangladesh's total exported goods in the just ended fiscal year 2020, with the United States leading with 17 percent export share (Hossain,2020). The European Union and the USA are significant markets for Bangladeshi garments. Due to the US-China trade war, global purchasers shifted work orders from China to Bangladesh (Rahman,2020).



Pie Chart 1 : Export destinations of Bangladeshi textile products in 2019. Source : (Hossain,2020)

In fiscal year 2018-19, Bangladesh earned \$40.53 billion, of which \$28.89 billion, or 71.27 percent, came from the America, Germany, the United Kingdom, Spain, France, Italy, Canada, Japan, Netherlands, and Poland (Hossain,2020).

2.2.4 Garments sectors are benefiting other stakeholders in the economy

The following tables shows that how other sectors of the national economy are benefiting by the Garments/Apparel sectors--

Banks & Insurance earn from RMG	Tk.4000 crore
Shipping earns from RMG	Tk.2550 crore
Transportation sector earns from RMG	Tk.1000 crore
Government earns from source tax	Tk.1325 crore
Ports earn as revenue	T.1240 crore

Table 2: Selected other beneficiaries of RMG sector. Source : (Ahmed,2021)

2.3 Emergence and Importance of Accord

The Accord and partnership represent a legally binding agreement between Bangladesh's labor unions, such as the Bangladesh Garments Manufacturers Exporters Association (BGMEA), the Bangladesh government, international labor organizations such as the International Labour Organization (ILO), and global brands and retailers (Chowdhury,2020). The Accord is a collaboration between over 200 garment companies, eight Bangladeshi labor federations, and two global labor organizations. To avoid harm to individuals and the environment, such as contaminated rivers and ecosystems, chemical limitations have been critical in reducing and preventing waste (Rose,2021). ISO 1200 is one of these standards, and Scruggs (2013) noted the need of cooperating with suppliers 15 on environmental activities across

extensive supply chains in order to enable effective communication and control. This unique safety pact requires clothes firms to make legally binding pledges to identifying and correcting dangers in their operations (Ahlquist,2021). Ultimately, any ultimate compliance system must hold both ends of the supply chain accountable for its implementation—factories and brands.

2.4 The supply chain mapping for clothing industry

Your Wedding gowns or winter hiking pants are just two examples of modern clothing that originates from all over the world. In one factory, zippers are made; in another, fortification for the knees and elbow is done; in yet another, all the other components are assembled. This is a complicated system with a wide range of constituent components. As shown in Figure 6, Muthu has attempted to depict the clothing supply chain, although he depicts it as "difficult to graph." Due to the fact that garments may have come from different production lines(Moin,2020).Synthetic and natural fibers are the primary raw materials for the garment industry.The production of synthetic fibers is thought to be energy-intensive. To make polyester, the most used raw ingredients are pure terephthalic acid, dimethyl terephthalate, and mono ethylene glycol (Golay,2021). Synthetic fibers are less water-intensive to produce than natural fibers. Wool, cotton, and even a combination of wool and cotton were among the natural fibers used by most of the corporations (Wagaye,2020).

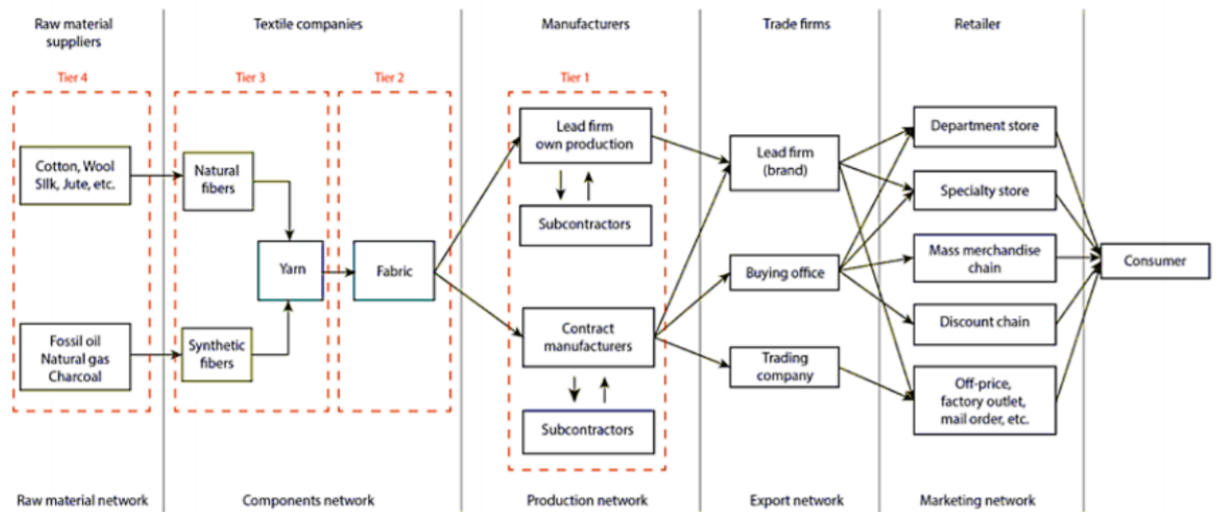


Figure 6 The textile and clothing SC. Source : (Moin,2020).

Many aspects of the apparel sector, such as short product life cycles, fierce competition, growing fragmentation, and extended production cycles, make it difficult to match supply with demand, as

Chaudhry and Hodge (2012) point out in their paper. It is required to recycle natural resources if they are used to produce a product that has a short life span because of e-commerce in the global supply chain of fast fashion industry (Khanzada,2020).

The value chain in this industry has numerous layers and might vary depending on the product type and the owner (See Figure 7). There are a number of advertising factors associated with the final apparel SC product that make it difficult to match supply and demand, including a short life cycle, high volatility and low predictability of market demand, and a high level of impulse purchase specially in festivals occasions(Fernie,2004).

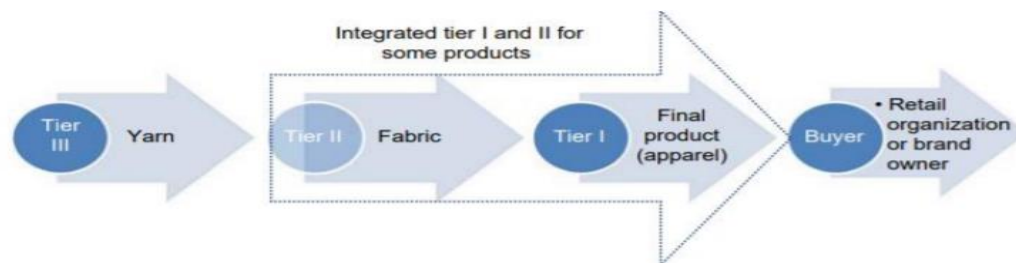


Figure 7 :Apparel value chain. Source : (Manchanda,2020)

According to a recent study by Heinemann and Schwarzl (2010), fashion products will have much shorter life cycles in the future, and innovation will be critical to ensuring high performance. According to the authors, "fast fashion" will eventually become the dominant business model not just in clothes retail, but also in other retail categories such as electronic device. This business model will necessitate the creation of quick and responsive (agile) supply chains, posing a considerable challenge to many merchants. Additionally, the authors assert that merchants will understand the advantages of specialization in the future, particularly in procurement, and that they will confront new obstacles as a result of resource limits and more conscious consumers' expectations for more sustainable products. According to Bruce and Daly (2011), because corporations have a finite number of resources, it is critical to reduce inefficient activities and improve customer order demand management in order to optimize production resources to maximize profitability. As a result, lean approaches are well suited for implementation in industries such as textiles and apparel, which are characterized by intense competition, Production resource scarcity, and a race for businesses to improve delivery speed and efficiency throughout their supply chain and to effectively serve customer offers. Agility, as defined by Christopher, Lawson, and Peck (2004), refers to the capacity to adapt swiftly in the context of supply chain management. The authors assert that prior SCs were forecast-driven, inventory-based, and required lengthy lead times due to their predetermination. On the other hand, agile SCs are often brief, data-driven, and demand-driven in nature. Due to the turbulent

and unpredictable nature of fashion markets, agility is required, and an agile SC possesses a number of characteristics that can be used to develop an agile SC for enterprises operating in the fashion sectors. They concluded, after conferring with Backs et al. (2020), that apparel markets are complex and that it is vital to choose the most advantageous SC strategy. The authors compare the classic SC strategy to the rapid fashion strategy. The traditional model is characterized by the outsourcing of manufacturing to low-wage countries. Despite declining labor costs, transportation and distribution durations are increasing, reducing the flexibility of logistical procedures. On the other hand, the traditional technique is usually employed to produce uniform clothing at the lowest possible cost. On the other hand, the rapid fashion strategy puts products into two distinct categories: basic products, which are obtained through the regular SC technique, and fashion clothing, which are obtained from producers located near the point of sale. Despite the fact that rapid fashion tactics incur higher production costs due to the high labor costs, they enable greater flexibility in responding to market demand. According to the authors, firms must consider a range of factors while deciding between these two SC techniques, including consumer preferences and purchasing habits, as well as the character and strategies of their competitors (Backs et al. 2020). Cachon and Swinney (2011) compared four approaches to garment supply chain management: a traditional approach, a quick response approach, an enhanced design approach, and a fast fashion approach. According to the authors, the consequences of these technologies on client purchasing behavior vary depending on the circumstance. To name a few aspects of old systems, they include lengthy lead times and homogeneous product design. Due to the firms' ability to acquire items several times, supply and demand are more closely aligned as a result of the quick response systems (a long time before the selling season and after receiving a forecast update). Even though all products are identical in design, the quick response system reduces the possibility of clearance sales which means less inventory and reduce warehouse cost hence increasing the company's revenue. Although the increased design system has a longer production lead time, buyers benefit from the improved designs of the items. Consumers no longer have to wait for clearance sales or impacted with supply shortages because they can purchase the items they deem more desirable. Finally, the fast fashion system combines the advantages of increased design and speedy response to create a one-of-a-kind experience. Finally Utilizing both methods concurrently benefits firms more than using them separately, particularly when consumers demonstrate strategic behavior, because the rapid fashion strategy increases profits for the corporation (Swinney 2011).

2.5 Fibres used in clothes

Cotton is the most extensively utilized natural fiber in the textile industry on a global scale. Today, cotton accounts for approximately 40% of textile output, while synthetic fibers account for approximately 55%. Between 1997 and 2001, international commerce in cotton products accounted for 2% of worldwide merchandise trade value (Zambrano,2021). Cotton production's environmental repercussions are readily observable and come in a variety of forms. On the one hand, there are the consequences of water depletion; on the other hand, there are the consequences of water quality degradation.

Cotton undergoes a number of various production steps from field to finished product, each with a unique influence on water resources. These stages of production are frequently carried out in separate locales, and consuming may occur in yet another. Malaysia, for example, does not cultivate cotton but imports raw cotton from China, India, and Pakistan for textile processing and exports cotton garments to the European market (Chapagain,2006). As a result, the impacts of consumption of a finished cotton product can only be determined by tracing the product's sources.

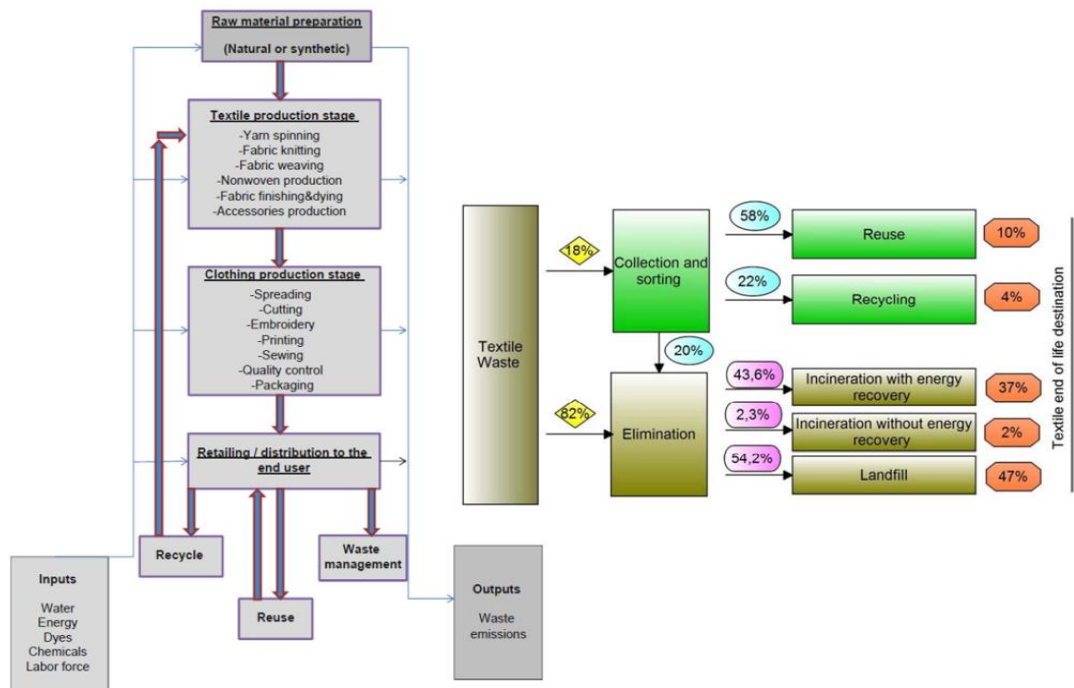


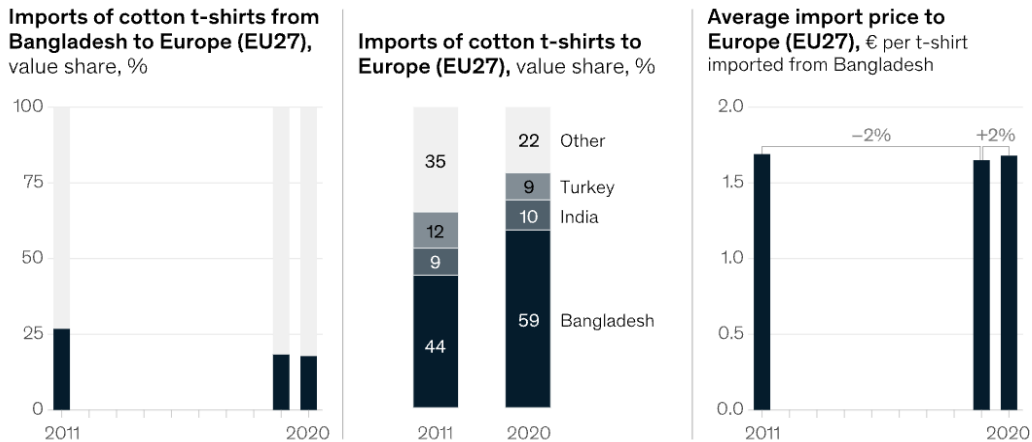
Figure 8 : Possible Textile disposal recovery scenario.Source : (Rudenko,2013)

Cotton manufacturing has an effect on water quality at both the growing and processing stages. The first stage's influence is determined by the amount of nutrients (nitrogen, phosphorus, potassium, and other trace elements) and pesticides that drain from the plant root zone, contaminating groundwater and surface water (Zhang,2021). Chemical accumulation in the soil (phosphorus) or the food chain (pesticides) is also a worry in some circumstances. The majority of pesticides used find their way into ground water or surface water bodies. Cotton is planted on only 2.4 percent of the world's arable land, but it accounts for

24% of the global insecticide market and 11% of the global pesticide industry (WWF, 2003). Nitrogen fertilizer applied to the field is partially absorbed by the plant, partially converted to N₂ through denitrification, which escapes the soil to the atmosphere, and partly leaches into the groundwater or is washed away by surface runoff (Aldaya,2012). In bodies of water, elevated nitrogen levels can result in algal growth and increased purification costs if the water is used for drinking. Approximately 60% of total nitrogen applied is taken from the field by harvested seed cotton (CRC, 2004). Silvertooth et al. (2001) estimate that around 20% of total nitrogen applied departs the field via leaching to groundwater, runoff, or denitrification to the atmosphere (Chico,2013).

Clothing production also consumes water and contributes to pollution. Denim manufacture accounts for around 20% of industrial water pollution, and the globe consumes 1.3 trillion gallons of water each year for only fabric dyeing alone which is enough to fill 2 million Olympic-sized swimming pools. Figure 8 illustrates how the majority (82 percent) of textile waste may be collected for reuse (Yukseler,2017).

The cotton t-shirt remains the iconic product for Bangladesh sourcing, despite price pressure.



Source: Eurostat; McKinsey analysis

Table 3 : Top RMG exporting countries and Environmental performance index of 2018. Source : (Levy ,2018)

Export Rank	Country	Global market share in %	Export in Billion \$	Current Rank EPI	Current Score *Baseline 27.3	Baseline Rank
1	China	34.4	158	120	50.74	180
2	Bangladesh	6.5	29	179	29.56	180
3	Vietnam	5.9	27	132	46.96	180
4	India	4.1	18	177	30.57	180
5	Turkey	3.3	15	108	52.96	180
6	Indonesia	1.8	8	133	46.92	180
7	Cambodia	1.6	7	150	43.23	180

Chapter 3 : Literature Review

3.0 Chapter Introduction

Chapter 3 is the literature review, which will go through some background related literature. This chapter contains a review of prior, relevant literature to this academic project and creates the foundation for this research and the subsequent discussions advancement of knowledge in sustainability and sustainable procurement in the Ready-made garments industry. The chapter contains literature reviews on sustainability and the models of sustainability; procurement and sustainable purchasing portfolio; and the innovative driver of sustainability that may meet the challenge of apparel industry and ended up with technological solution that has taken from various recent publications.

3.1 Literature Review

Concerns about the non-renewability of natural resources as a constraint on production and the inherent threat to long-term economic growth posed by resource depletion and environmental degradation have been prominent in recent decades (Griggs,2017). The Millennium Development Goals (MDGs) reflected widespread concern about poverty, disease, hunger, gender inequality, unmet educational needs, and ecological degradation, and established an unprecedented and effective mechanism for global mobilization to address these critical social priorities (Rametsteiner,2003). In a world beset by climatic change and other grave environmental ills, universal agreement exists on the critical role of environmental goals alongside poverty reduction goals in the formulation of global policy. Thus, the Sustainable Development Goals (SDGs) concept has gained support as a recognition of the crucial nature of global sustainable development. On September 25, 2015, the United Nations' 193 member states adopted a series of goals aimed at eradicating poverty, safeguarding the environment, and ensuring prosperity for all as part of a new global sustainable development strategy called the Sustainable Development Goals (Griggs,2017). The SDGs are referenced in paragraph 54 of United Nations Resolution A/RES/70/1, published on September 25, 2015. (Source: United Nations, 2015).

3.2 Sustainable procurement

Purchasing goods and services in such a way that they provide the best value for the money while also taking into account social and environmental factors is known as "sustainable procurement" (Walker,2012). It might be challenging to incorporate sustainable procurement practices into an existing business model (Renukappa et al. 2016). Sustainable procurement techniques have been examined through a series of case studies and interviews in order to learn about the advantages and potential

drawbacks of implementing them. The inclusion of sustainable procurement measures in annual reports, for example, was found by Walker and Philips (2006) to help employers recognize that procurement is required to meet this goal. An increase in customer knowledge about purchasing products that are both environmentally and socially responsible can help fill market gaps (Walker and Philips 2006). In addition, the authors discovered two other factors that can assist firms in becoming more environmentally friendly. The first step is to promote consumer involvement and knowledge of environmental, ethical, and social responsibilities. Procurement managers could benefit from such a campaign by better understanding what their customers want and need. One way to underline the need of sustainable procurement is to include SP measures in public annual report forms, so that businesses can not only reflect but also act and report (Walker and Philips 2006). To lessen the environmental impact, it is necessary to study the production and consumption patterns of the population. Supply chain management is essential for increasing product usage and reducing environmental impact (Renukappa et al. 2016). More and more organizations care about the environment in product creation and evaluation, thus environmental performance criteria must be included in supplier selection (Kalubanga 2012). In addition, the company's procurement policies and supplier selection criteria should incorporate sustainable components, he says (Kalubanga 2012). Sustainable procurement in the UK construction industry was investigated by Renukappa et al. (2016) using semi-structured interviews and a survey. A number of businesses have responded, with a focus on long-term viability and sustainability. Materials and equipment providers therefore need to do more to ensure that social and environmental responsibility are assured.. Many people looked for providers based on factors including price, quality, and delivery time. When suppliers don't prioritize sustainability, aren't aware of the financial benefits to be gained, or lack leadership, these are all issues that should be brought to light. A more complex and expensive business model discourages customers from spending more on environmentally friendly products (Renukappa et al. 2016). Supply chain difficulties are only one aspect of procurement's impact on sustainability, which extends far beyond the organization itself (Renukappa et al. 2016). For a strategy to be effective and long-term, it needs to be backed by non-profit partners (Crespin-mazet and Dontenwill 2012). Crespin-mazet and Dontenwill (2012) also emphasise the importance of top-level commitment in their research. Market participants are focused on short-term gain at the expense of long-term social and environmental responsibility (Renukappa et al. 2016). The activities of well-known suppliers must often be taken into account by well-known companies due to the attention they receive from stakeholders (Walker, Di Sisto, and McBain 2008). Promoting sustainable procurement practices requires cross-sector cooperation (Renukappa et al. 2016). There is a great deal of legal pressure to ensure sustainable procurement, as stated by Vluggen et al. (2019). Pressure for sustainable procurement comes mostly from the involvement of private businesses in the political process.

One of the most important aspects of sustainable purchasing is taking into account the risks, accomplishments, and consequences on the environment and society at large (Renukappa, 2016).

3.2.1 Sustainable economic procurement

According to The Chartered Institute of Procurement & Supply (CIPS), one of the economic drivers of sustainable procurement is increasing the economic value of procurement procedures (or processes) (2012). Sustainable pricing and prompt payment of suppliers are all part of ethical trading to help supply marketplaces and suppliers remain financially viable in the long run (Leal Filho, 2018). It is a very labor-intensive and complex sector that necessitates a significant investment in exploration, operation and maintenance (Breuer, 2019). Additionally, highly specialized products, services, and technologies are used in the industry's exploration and operation. That's why organizations rely heavily on their purchasing departments to keep their purchases and investments safe as well as to give value for money. This is especially important given the fact that the RMG market has been experiencing a declining trend in prices over the last few years. The RMG industry in Bangladesh must therefore strike a balance between its social, political, and environmental responsibilities and the basic reason for its existence, which is to make profit.

3.2.2 Sustainable Environmental Procurement

Globalization and the associated desire to improve environmental performance drove global industry forward (Zhu and Sarkis 2006). Thus, natural resource conservation and environmental protection have become a national and worldwide imperative (Kumar, Somnath and Vinay 2012). Sustainable supply chain management (SSCM) encompasses environmentally friendly manufacturing, green procurement, environmentally friendly distribution and marketing, eco-accounting, and reverse logistics (Kumar, Somnath and Vinay 2012). Environmental procurement addresses issues such as climate change mitigation, resource conservation, emissions reduction, waste management, 'green' material specifications, 'green design and innovation, environmental standards across the supply chain, and disposal and recycling (CIPS 2012a)

3.2.3 Sustainable Social Procurement

The social dimension of sustainability has gained prominence in corporate writing in recent years. This could be because stakeholder awareness and interest in issues such as child labor, minimum wage rises, health and safety, fair trade, and community development are increasing, and organizations that ignore these issues risk losing their reputation. According to Jones et al. (2010), the social pillar of sustainability is an organization's commitment to have a beneficial impact on the communities in which it operates. Businesses implement and conduct business ethically as part of the social dimension of sustainability

(Beheiry et al., 2006). Social procurement is the use of purchasing power for the purpose of generating social value (Barraket and Weissman 2009). Responsible procurement refers to procurement techniques that balance commercial considerations with social, labor, and environmental performance (Responsible Purchasing Initiative, Taking the Lead 2007). Responsible procurement is frequently used to refer to the social dimension of sustainability, which encompasses 46 themes such as community development, labor conditions, and labor relations; fair trade; social inclusion and diversity; social justice; and human rights. Social procurement efforts of the company may have an effect on all persons and communities (CIPS 2012a).

3.2.4 Interlocking circles models of sustainability -Triple Bottom Line

According to Dyllick and Hockerts (2002), many businesses are incorporating environmental considerations into their business models in order to adhere to the triple bottom line (TBL) concept of meeting the needs of current and future generations on three dimensions: environmental, social, and economic (Dyllick and Hockerts, 2002). (2009) (Birkin et al.). According to Closs et al., increased profits can be reached by lowering global waste and costs, as well as reducing dependency on finite environmental and natural resources such as raw materials, water, and labor (2011). Additionally, developing people's and communities' commitment to globally acceptable working conditions and best practices is possible. Many people believe that a company's long-term efficiency and profitability can be increased by implementing a sound triple bottom line strategy that takes economic, environmental, and social aspects into account (profit, planet, and people) (Closs, Speier and Meacham 2011). Before adopting sustainable procurement, there are numerous "components" of sustainability that must be identified and analyzed. It was discovered that (Krause and colleagues) (2009). The triple bottom line's ethical dimensions are now recognized in the literature: economic performance, environmental stewardship (the preservation of natural resources through waste minimization and emission reduction), and social equity (the firm's purchasing social responsibility) (such as human rights, local community and people development, cultural diversity, fairness and safety). Environmental components are increasingly being integrated into business models in order to comply with the triple bottom line concept, which asserts that sustainability must balance economic considerations with social and political systems as well as environmental needs (Fiorino, 2010). (2009)b (Birkin et al.). Additionally, according to the TBL method, organizations must make efforts to safeguard the environment and enhance society (Fig. 9). The triple bottom line strategy enables a business to adopt a responsible position on economic development, environmental stewardship, and social justice (Bai and Sarkis 2010)

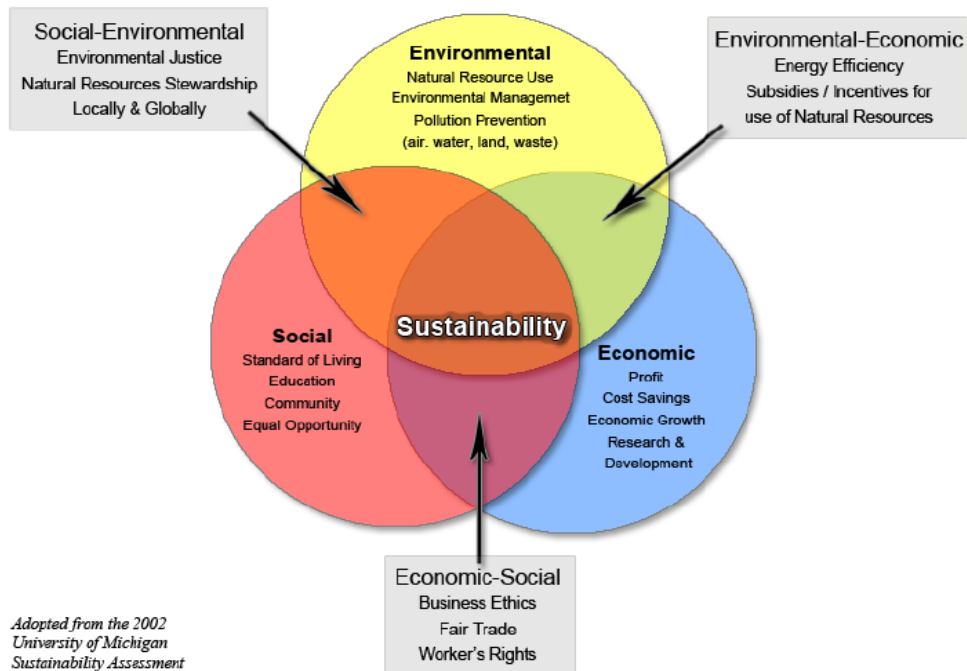


Figure 9 : The three spheres of sustainability. Source : (Boyer,2015)

3.4 Sustainable Product/Services

Based on the preceding research, a sustainably procured product is one that ensures value for money for the purchasing organization, protects the environment in its use or operation, and is sourced ethically. CIPS (2012) stated that a sustainable product should include the following characteristics (De Medeiros, 2014):

- i. Providing value for money
- ii. Resource and energy efficient
- iii. Manufactured using least possible virgin materials
- iv. Manufactured using the maximum possible post-consumer usable raw material
- v. Non-polluting (or at least, causing the least possible pollution)
- vi. Durable, easy to upgrade and repairable
- vii. Re-usable and recyclable
- viii. Ethically Source

The existing system is mostly take-make-dispose. This system wastes resources, pollutes and degrades ecosystems, and has substantial local, regional, and worldwide socioeconomic repercussions. Every year, almost USD 500 billion is lost (Ganjezadeh,2017). Clothing underutilization and non-recycling pose problems for the Knowledge Society. The conventional approaches to reuse waste concerning

sustainability, and resource efficiency are symptom-based and have not addressed increased consumption (Smith et al., 2017). Circular economy (fig. 10) can help bridge the gap between natural resource scarcity and rising global population or consumption (CSR Europe and University of Malta, 2018; European Apparel and Textile Confederation, 2017) by encouraging the adoption of closing-the-loop production patterns within an economic system (Ghisellini et al., 2015). (Ghisellini et al., 2015). We need to rethink production and consumption systems, and educate businesses and consumers on circularity (Smith et al., 2017). Discovering and comprehending the social situation, the appropriate action, what works best for both corporate and social mission, up to creating a profitable product or service, and engaging stakeholders through a circular business ecosystem.

Fontell and Heikkilä (2017) developed a circular business ecosystem applied to the textile and apparel sector (fig. 10), characterized by four hierarchical loops of textiles: maintain and repair, re-use as product, remanufacturing and re-use as material, and recycle.

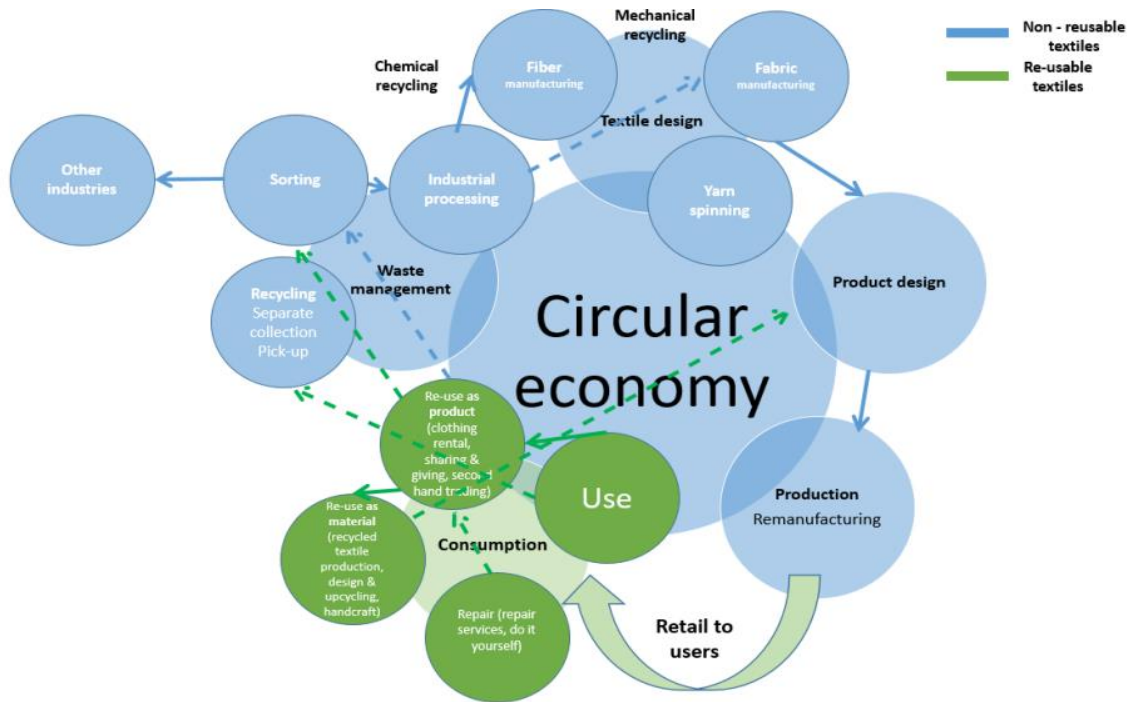


Figure 10 : A circular business ecosystem for the textiles and apparel sector. Source : Fontell,2017

3.5 Leagile

The push and pull principles are commonly referred to as two diametrically opposed poles in the field of logistics. Push is frequently described as the anticipation of future demand with the use of assumption, for example, an ERP system to estimate the impending demand. Push is also known as demand forecasting.

With a pull system, on the other hand, one responds to the direct customer demand and then produces what is required. The amount of storage space is maintained to a bare minimum (Powell, Riezebos, and Strandhagen 2013). So it might be said that a push system takes a lot of storage space whereas a pull system does not require nearly as much. It is important to note that the type of strategy is related to the usage of resources as well as the level of environmental effect, which has a direct impact on consumption. Lean is also about creating long-term relationships with collaborating partners, such as its suppliers, and has shown to be extremely crucial for industrial practices in the past few decades. Toyota, widely regarded as the originator of lean thinking, regularly dispatches its engineers to operate on the premises of its customers. As a result of this partnership, both organizations benefit from a mutual exchange of information, which ultimately leads to the improvement of their working processes. In addition, the term "Kaizen" is used, which loosely translates as "life-long learning" or "continuous improvement." This means that the firm is always improving its people, processes and standards while also learning from its customers and suppliers (Keough 2012). Agile software development, on the other hand, is a working strategy for enhancing the software development process (Ambler and Holitza 2012). It began in the software and information technology industries. Agile project management might be described as the process of moving a project to the next phase of the process, about balancing the limitations of cost, scope, and time while still remaining flexible to allow for changes throughout the project lifecycle (Koppensteiner, Sonja and Udo, 2009). The ideas of agile are adopted by companies working on anything from pacemaker systems to banking to automobile electronics, making it a widely utilized methodology (Ambler and Holitza 2012). Christopher (2016) outlines the notion of agile supply chains, and in this section, he emphasizes four characteristics that must be present for an agile supply chain to be successful: virtuality, process alignment, network-based operations, and market sensitivity. The supply chain is virtual, which means that it is driven by information rather than inventories. Process alignment, demonstrating that the entire supply chain is working together effectively. It has a broader scope, according to Christopher, than just the single organization. Being network-based recognizes the organization's commitment to working toward a common objective and following a common set of principles (Christopher 2016). When Naylor, Naim, and Berry (1999) created the term "leagile," they were describing the dangers of considering lean and agile as isolated components, and how firms should instead endeavor to discover their decoupling point and get market knowledge about the entire supply chain (B. Naylor, Naim, and Berry 1999). Naylor and colleagues refer to the decoupling point as the crucial path in the supply chain, where important activities take occur. They use examples such as the clothing manufacturer Benetton, where the critical point is the dyeing process of the jumpers, as an example (Berry 1999). Lean and agile systems are separated by a decoupling point, which allows both systems to operate in the same supply chain at the same time (Krishnamurthy and Yauch 2007). In many

cases, it is stated that lean works best in competitive markets where there are solid insights into market demand, whereas agility works best in dynamic and competitive marketplaces. Galankashi and Helmi (2016) identify six elements of a successful sourcing strategy that is based on leagile concepts and practices.

- 1) When sourcing for suppliers, it is important to consider the unpredictable nature of demand;
- 2) managers have a responsibility to investigate the characteristics of demand and supply;
- 3) it is necessary to adopt a feasible solution of leagile, rather than treating lean and agile as two separate entities.
- 4)The business's upstream activities should be cost-effective, for example, leaning toward leaning, while the downstream activities should give the organization the flexibility it needs to deal with volatility.
- 5) The four pillars of leagile management, namely strategy management, logistics management, collaborative management, and marketing management, should be examined in conjunction with the suppliers' contributions.

In order to implement an effective leagile sourcing approach, it is necessary to identify the decoupling point. One of the most important parts of a successful leagile deployment is a comprehensive implementation, which includes more than just the sourcing strategy (Galankashi and Helmi 2016).

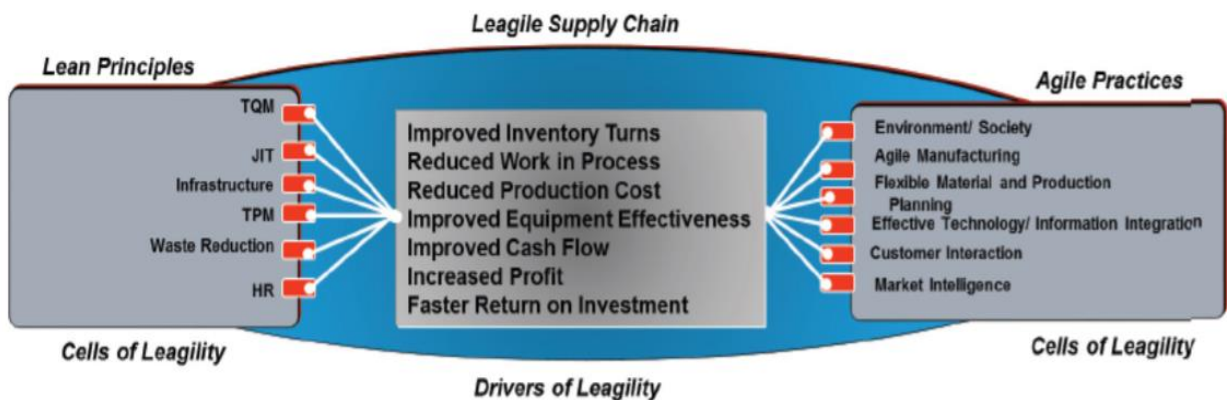


Figure 11 : - Lean-Agile interaction in a leagile SC .Source : Matawale,2013

Effective inventory management is a prerequisite for lean manufacturing as well as agile manufacturing process. Bridging the two paradigms is based on this similarity. Kant and colleagues (2016) Cost efficiency, compliance quality, delivery speed, and reliability are all reflected in lean operations. There is some overlap between leanness and agility, as demonstrated by the fact that delivery speed and reliability are enablers of agility (Hassan and Sheriff. 2015). It is unlikely that Leanness and Agility can be considered in isolation, according to Banerjee and Ganjeizadeh (2017). It is well accepted that leanness

and agility have an overall synergistic effect on SC, based on multiple studies. Banerjee and Ganjeizadeh (2017) drew the following synergies of leanness and agility on corporate goals:

Value identification in products results in customer enrichment (Agility) (Leanness)

Competitive advantage (Agility) can be acquired through improving the flow of material and information (Leanness).

Execution of the operation at the time of need (Agility) improves systemic planning (Leanness) Adopting IT and technology improves communication within and between departments (slackness) (Agileness)

Leanness is a strategy for maximizing the value of information (Agileness)

3.6 Stakeholder Theory

Stakeholder theory is a concept of organizational management and corporate ethics that includes employees, suppliers, local communities, creditors, and so on. According to stakeholder theory, a company's goal is to maximize stakeholder value (Geyskens,2006). To prosper and be sustainable, Procurement managers must align and promote the interests of consumers, suppliers, employees, communities, and shareholders.

Freeman is the "founder of stakeholder theory." argue that in capitalism, stakeholders act in concert around shared values. Parties must negotiate to develop common interests. Applying this to sustainability management needs sustainability to be one of the values around which stakeholders collaborate. 3 main challenges encapsulated (Freeman,2010):

1. Attaching sustainability in the approach of all stakeholders
 2. Creating mutual sustainability interests based on the particular sustainability interests of single stakeholders
 3. As nature is often not considered adequately by the most powerful immediate stakeholders (Starik, 1995) sustainability management is challenged to create approaches that empower societal stakeholders
- Concerning the first obstacle, Stead and Stead (1996, p. 153) acknowledge the existence of "a sizable cadre of stakeholders" with environmental concerns and explore their respective interests and powers. Consumers (including other firms), financiers, employees, environmental interest organizations, regulators, lenders, and insurers, as well as standard setters, are all identified as stakeholders (including business associations).

The second issue is to not only embed sustainability in the consciousness of all stakeholders, but also to build mutual sustainability interests around the unique sustainability interests of individual stakeholders. While it is likely that all stakeholders have specific sustainability interests, they may be divergent or even competing. To achieve sustainable development, it is critical to establish that the underlying value of these interests is sustainability and to establish mutual sustainability interests based on each stakeholder's unique sustainability interests.

Regarding the third difficulty, Starik (1995) emphasizes that, as the situation of nature deteriorates, social stakeholders are currently failing to address nature appropriately. It is critical to ensure that the interests of nature are not disregarded but are represented by intermediaries, even more so if nature is not considered a stakeholder. The first challenge proved the existence of several societal stakeholders capable of serving as such intermediaries. To overcome the aforementioned difficulties, Figure 12 proposes three interrelated approaches (labeled education, regulation, and value generation). These mechanisms seek to (1) enhance stakeholders' sustainability mindsets, (2) establish mutual sustainability interests based on specific sustainability interests, and (3) enable society stakeholders to function as nature's mediators.

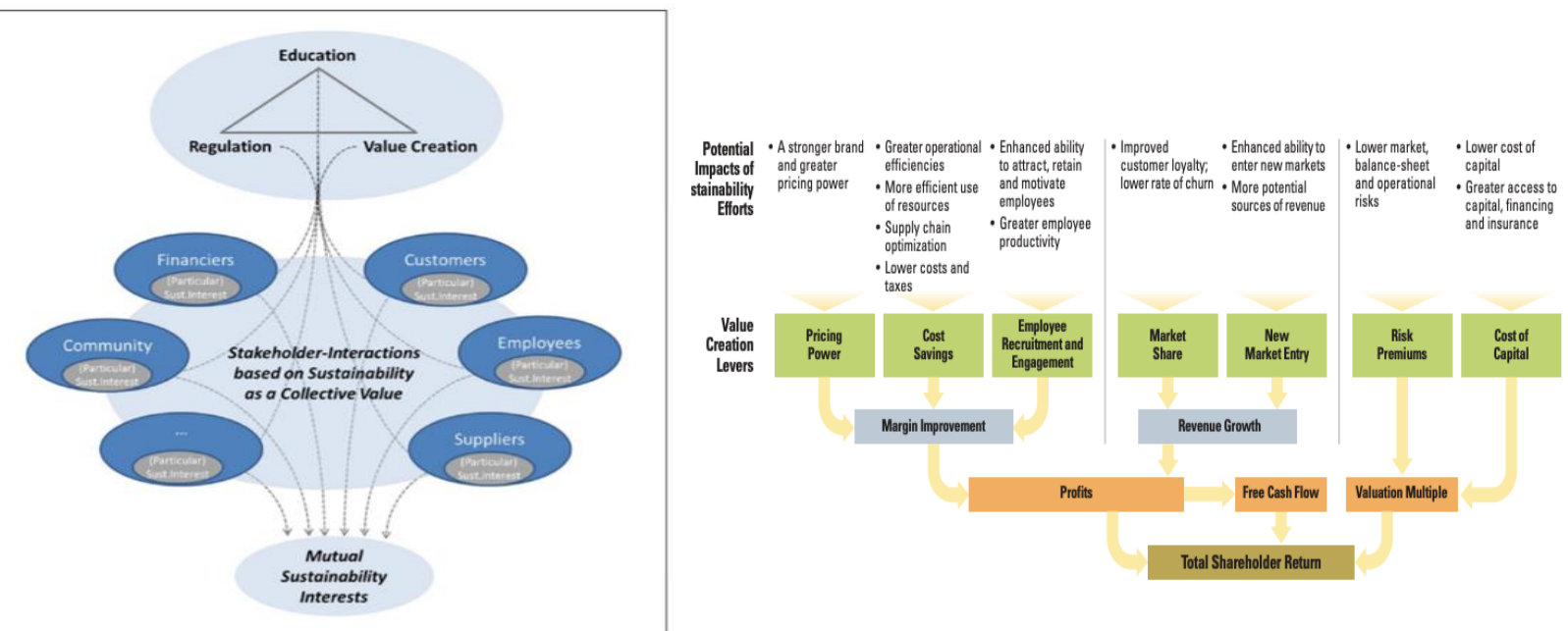


Figure 12 A framework of stakeholder theory for strengthening the sustainability mindset, creating mutual sustainability interests, and empowering stakeholders.. Source : (Geyskens,2006)

3.7 Natural Resource based view

In the world of fashion, competitiveness and sustainability are two of the most important issues to deal with (Nagurney & Yu, 2012). Closed-loop supply chain management, in particular, is a focus of attention in the fashion supply chain (Oh and Jeong, 2014). The natural resource-based approach to business planning displays the firm's ability to obtain a competitive advantage through its resources.

An important resource theory (Wernerfeldt, 1984) informs the NRBV's understanding of sustainability. Furthermore, the NRBV claims that environmental and social issues can be used as a competitive advantage (Hart, 1995). In addition to cash incentives, competitive advantages can include improved efficiency, differentiation, and access to scarce resources and unsaturated markets (Hart & Dowell, 2011). To incorporate the sustainability, it can be said that managers are increasingly motivated to meet their environmental and social responsibilities (Berger-Walliser & Shrivasta, 2015). (McDougall, 2018). The natural resource based-view advocates a 'environmental revolution' (Hart, 1997) that aims to reshape the way businesses operate in a fundamentally new era of circular transition (Svensson & Wagner, 2012).

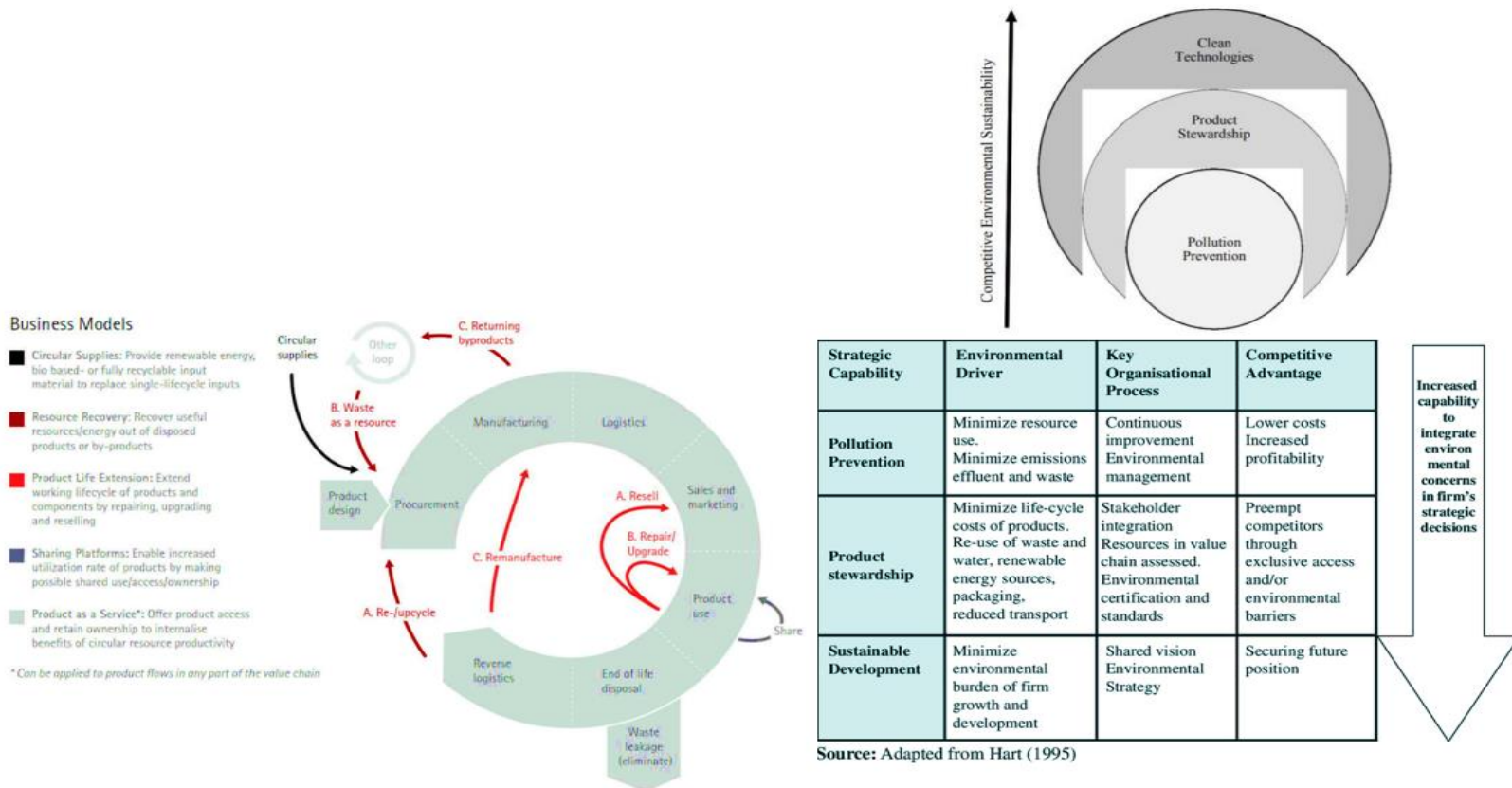


Figure 13: A natural resource based view of maximizing resource capacity towards circularity as a viable business model (Hart,1995)

Based on variety of studies providing conceptual insights in what green supply is (Russel 1998; New, Green et al. 2000; Bowen, Cousins et al. 2001; Sarkis 2001; Preuss 2005; Seuring and Muller 2008), it can be referred to (Fig 13)

Ensuring sustainability of purchased products. In this situation, the buying firm may require that sourced materials or components adhere to certain requirements in order to be purchased. As a result, environmental laws could apply to more than just finished goods in some cases. Additionally, initiatives to green product-based supply could be focused on by-products, such as reducing the quantity of product packaging used, among other things,

Ensuring sustainability of manufacturing processes. As such, buyers may compel suppliers to adopt environmental policies and attain environmental management standards (official certification like ISO 140001 or (The Eco-Management and Audit Scheme)EMAS, or internally developed systems). Environmental performance of acquired products and manufacturing processes “may also be a requirement for contract awarding in the first place. The same method can be used to give repeat business to established suppliers” (Preuss 2005).

Developing product-based supply (managing green supply offers). Using this strategy, suppliers will be evaluated according to various sustainability criteria. If corporations were to award contracts only based on environmental performance, purchase decisions would have to take into account a number of trade-offs. Obviously, in some cases, one supplier might have a superior quality/price ratio, while the other would have a better environmental record. In order to address these kinds of conflicts, the purchasing and selling companies would need to talk about the possibility of better integrating conventional and environmental/social factors.

Developing process-based supply (Influencing consideration of environmental concerns within supplier company). As a result, buying businesses may become involved in supplier internal environmental initiatives such as eco-design programs and waste recovery infrastructure. Adjusting distribution networks could enhance transportation/load efficiency and thus environmental performance. This would need a high level of trust and higher organizational effort, but might result in significant supply chain sustainability improvements.

Developing well-functioning relationships with suppliers. Better buyer-supplier connections may contribute to better production methods, decreased supply/sales risks, and successful environmental/social concerns treatment. Relationships can assist organizations overcome organizational obstacles and establish internal technical capabilities to ensure/grow green supply.

Pagell's sustainable purchasing portfolios model considers three-dimensional performance (TBL) and separates leveraged items into three subcategories: strategic commodity, transitional commodity, and true commodity. This division emerges when a firm tries to optimize supply chain performance using TBL (Pal,2020). For example, managers must account not only for profitability, but also for TBL hazards. However, broad suggestions for relationship management with strategic suppliers have not changed. A similar strategy is used for non-critical product categories (bottlenecks). In this approach, switching providers would be simple, and distinction would be applied to one area, namely environmental impact within the same price range (Pagell, Wu et al. 2010). In a situation with knowledge asymmetries, commodity is deemed transitory. While supply risk is significant, relationship-based investments would be made in formerly commodity-type inputs. Supply risk would be reduced as information asymmetries decreased and suppliers met stakeholder expectations increased. As a result, purchasing methods will revert to commodities strategy (Pagell, Wu et al. 2010). The most challenging category to manage in the short run... Avoiding excessive costs and hazards requires recognizing the transformation (Pagell, Wu et al. 2010: p. 69). Commodity becomes strategic to assist corporations gain long-term competitive advantage. Managing commodity inputs strategically goes beyond simple market economics, where buyers should downgrade suppliers to lower risk categories.



Figure 15 Sustainable purchasing portfolio. Source : Johnsen,2017

On the opposite, supply risk in case of strategic commodity is consciously increased, with expectations that it would contribute to high level of TBL performance on variety of dimensions. Improvements on multiple aspects of TBL distinguish strategic commodity from true and transitional commodities (where differentiation exists only on one dimension, e.g. price or social, or environmental impacts) and make asset specific investments worth it overtime (Pagell, Wu et al. 2010)

3.8 Buffering in the supply chain during COVID 19 outbreak

Global Supply Chains are currently experiencing an unprecedented crisis, COVID-19, which is not only a global health crisis but also an economic challenge for civilization. The coronavirus started in Wuhan, China, affecting the Chinese supply chain first, then the entire global supply chain (Sergeevna, 2020). The exponential rise in COVID-19 cases in the US, Europe, and Asia has resulted in border restrictions, affecting the worldwide supply chain. The shift in commodity consumption has wreaked havoc on global supply chains, manufacturing, shipping, and procurement. The current economic instability has impacted the textile, garment, and fashion supply chain. The fashion business has witnessed its biggest slump since 1992. (Zhao,2021). The worldwide structural supply chain buffering has been produced by changes in aggregate demand, global economic slowdown, industrial plant closures, and coronavirus epidemic. For example, before the epidemic, China produced over half of the world's masks (Wang, 2020). The COVID-19 lockdown in China disrupted

face mask production, resulting in global shortages at the start of the epidemic. The “bullwhip effect” causes delays and inefficiencies from manufacturers to end users, especially for commodities like surgical masks (Fig. 14). Because Bangladesh is a major provider of textile and apparel inputs, the impact of the disruptions in China spread to the global market. The majority of raw materials components for mass manufacturing and procurement in Asia are imported from China (Chakraborty,2020).

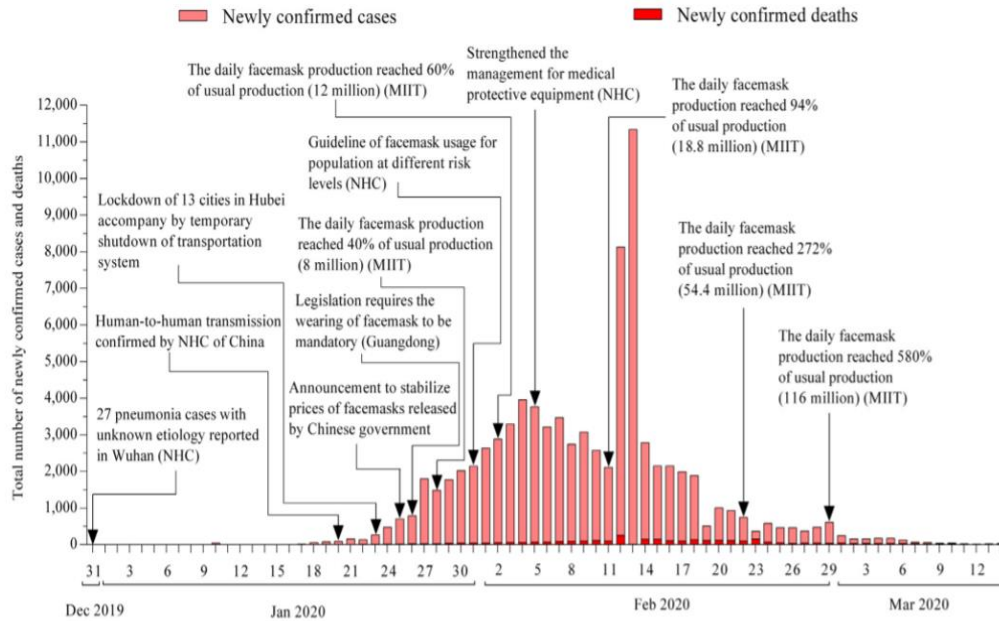


Figure 14 Daily new confirmed cases and deaths during the novel coronavirus disease (COVID-19) outbreak in China. (Publicly available data from official websites of the National Health Commission (NHC), the Ministry of Industry and Information Technology (MIIT), the center for Disease Control and Prevention (CDC), and General Administration of Customs (GAC) of the People's Republic of China)

The pandemic has paused down the most of transportation links and distribution mechanisms between suppliers, production facilities and customers. Therefore, it is imperative to think about redesigning production and consumption pattern in the post pandemic situation.

3.8.1 Bullwhip effect in the supply chain

The bullwhip effect occurs when changes in demand cause a shift in product requests from the consumer to the retailer, wholesaler, and finally the production (Dejonckheere,2004). “The bullwhip effect is a supply chain inefficiency caused by expectations. A rise in inventory variation in response to customer demand shifts as the supply chain moves up (Jaipuria, 2014).

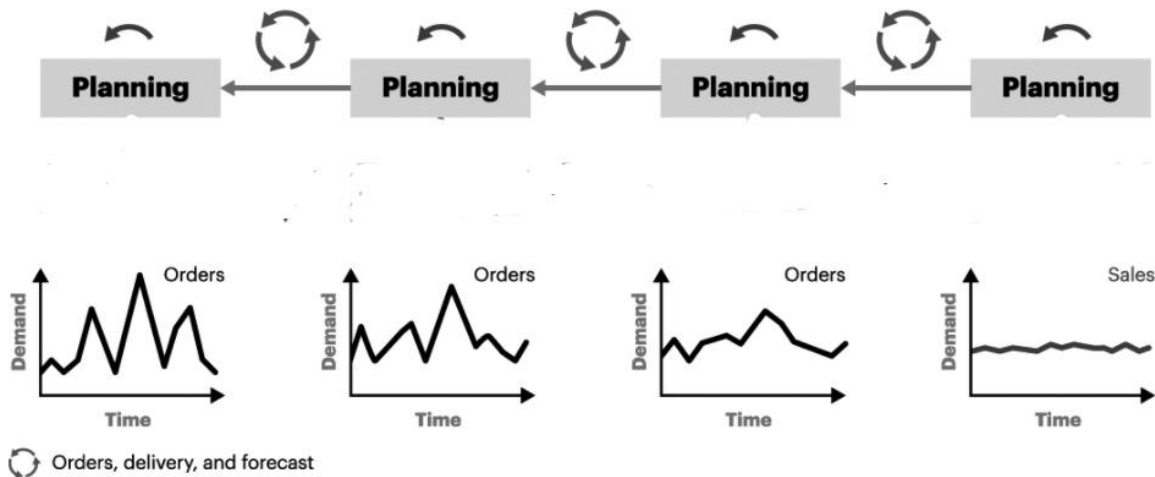


Figure 16 : Illustration of Bullwhip effect in SC (Dejonckheere,2014)

There are three reasons for which Bullwhip effect occurs.

- i) **Shortage of information-** Bullwhip effects occur when there is a mismatch in information between upstream and downstream in the supply chain (bsaikrishna 2016)Figure 16: Bullwhip effect Source:(bsaikrishna 2016)
- ii) **Design of Supply Chain-** The architecture of the supply chain is a factor in the Bullwhip effect. Manufacturers cannot fulfill their obligations to the upstream supply chain partners if the supply chain is not set up in a way that raw materials arrive at the proper time. This issue is commonly referred to as the increased lead time. (bsaikrishna 2016).
- iii) **Local Enhancements-** Bullwhip effects occur when local capitalization is not attained. (bsaikrishna 2016)

3.8.2 Supply chain disruption

As a result of COVID-19's simultaneous peak in supply and demand, order cancellations have a long-lasting influence on the worldwide supply chain. Fashion products have seen a dramatic shift in demand as a result of the shutdown of shops and the lockdown of consumers. It was observed that European consumer spending decreased by 27 percent in the seven weeks following lockdowns, according to a study by Andersen and colleagues (2020). (Debata,2021). According to the authors, the economic slump and job losses have shifted consumer spending toward necessities. Sales of H&M and Zara's parent firm Inditex fell 24.1 percent in the first two weeks of March 2020. Nearly all stores in China have already reopened, but Inditex still reports that 3785 stores in 39 other regions remain closed for the time being (Zhao,2021).

	Key event	Consumer response	Business response
Dec 1, 2019	1 st case detected in Wuhan	❖ Panic buying in virus containment products e.g. face masks / hand sanitizer	US / European brands concerned of delivery issues in China, urging for expediated shipment before CNY. Some brands adopt "wait and see" approach
Feb 12, 2020	South Korea spike		Supermarket prioritized essentials and food items and, reduce textile on-shelf availability
Feb 19, 2020	Iran outbreak	❖ Stockpiling of shelf-stable foods, home entertainment, office supplies etc., grow in basket sizes with decline in store visits	E-commerce companies like Amazon had plan to hire 100K Workers as panic-buying intensifies. US / Europe stores control operating hours
Feb 21, 2020	Italy and Europe outbreak		Major brands started to cancel orders - M&S cut clothing orders by GBP100M. \$1.5B in Bangladesh orders were cancelled within a week , representing 75% of orders till July. 80% of factories might not be able to sustain longer than 30 days
Mar 11, 2020	WHO declared COVID-19 as pandemic		
Mar 19, 2020	Almost all states in US declared emergency	❖ Increase in online shopping	Stores in China like Nike, started to resume operation

Figure 17- Consumer response towards market during COVID 19 outbreak (Sergeevna,2020)

Online sales were also down, falling by 4.9 percent between 1 February and 16 March in the history of retail in fashion industry (Inditex 2020). The fast fashion SC's low-lead time strategy is partially based on assumptions about consumer demand (Pearson et al. 2010). Many firms have cancelled orders and/or invoked 'force majeure' clauses as lockdowns and declining economic conditions reduce demand for imported goods (Teodoro and Rodriguez 2020). Again, we see a scenario in which epidemics can endanger both upstream and downstream supply chain components.

3.8.3 Disruptions of Procurement within during COVID 19 outbreak

SCs experience a rapid and powerful impact in the event of typical disruption threats (such as natural catastrophes, man-made disasters, legal conflicts and strikes). As a result of a "ripple effect" where SC effectiveness is increasingly hindered with each ripple propagation, disruptions spread downstream in one stage of the SC if there are not enough "buffers" (Gandasari, 2020). Because of the lack of buffers in supply chains with short lead periods, disruptions can spread more quickly. As a result, epidemics can have a devastating effect on global economies.

70 percent of the woven fabrics used in Bangladesh's apparel sector and 90 percent in Myanmar's come from China, respectively (Islam,2020). When China imposed lockdowns in early 2020, this supply chain was momentarily disrupted. Also underlined is the fashion SC's regional and interconnected character, which renders it subject to epidemics and their subsequent rippling effects. China's industrial capabilities were threatened by the continuing lockdown in Southeast Asia, Europe, and the Americas when companies returned to manufacturing and stores reopened in China. SC disruption is much more of a problem in the fast fashion industry, where clothing is often sold every two to four weeks. Fashion SCs that are vulnerable to epidemics have thus been created as a result of the desire to save money and improve the functioning of the SC (Nguyen,2021).It indicates that three elements characterize disease outbreaks:

- (1) Volatile interruption over the long term
- (2) The ripple effect in the SC growing interruptions
- (3) Simultaneous disruptions in the logistics networks

In this scenario, both suppliers are located in the same geographic area. An economic shutdown might leave both suppliers unable to fulfill requests. Lockdowns are more likely to affect the fashion business because it is a non-essential service. When epidemics spread asynchronously and countries have varied control responses, an unique dimension of epidemic disruption is observed: different parts of the SC can be disrupted at different periods, either as a result of a downstream ripple or as the direct result of local lockdowns. Due to their dependence on low-cost procurement and production from emerging nations, the textile and apparel industry is particularly vulnerable to disruptions (de Vet,2021). China's rising wages in recent years have resulted in some production shifting to nations like India, Pakistan and Vietnam. In spite of these factors, China is an important part of the SC, functioning as a major supply of inputs, a manufacturer of more high-end products, and an end-user. The fashion business relies largely on China on a worldwide scale. A vulnerability has been exposed in terms of supply chain resilience due to COVID-19's impact on it. This new reality is a unique chance to study how the RMG business is operating in the face of an unpredictable climate with vulnerabilities testing its supply networks (Kinda,2020)

THE LONG HAUL OF SUPPRESSION IS MARKED BY PERVERSIVE RISK OF DISRUPTION THAT WILL HAVE A DIRECT IMPACT ON PROCUREMENT FOR MONTHS OR YEARS

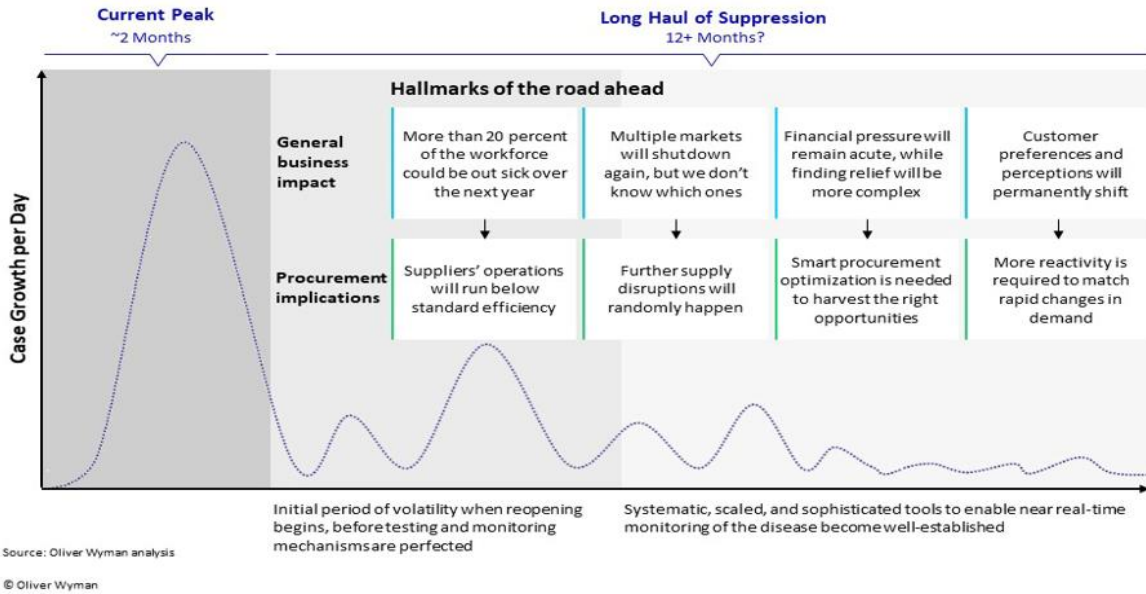


Figure 18 Disruption impact on procurement. Source : (Butt,2021)

3.9 Supply Chain Resilience

Mensah and Merkurjev (2014b) define resilience as a substance's capacity to regain its original shape following deformation. In a robust supply chain strategy, this is the capacity to recover from interruptions in the upper and lower streams. Sheffi and Rice Jr. (2005) state that decreasing vulnerability involves increasing resilience and decreasing the risk of disruption. According to the article, a company's resilience is determined by its competitive position and supply chain responsiveness. It also requires a focus on business process management to improve capabilities across the entire supply chain; visibility to demand and supply; supplier and customer relationship management; as well as instilling a culture of resilience (Pettit, Croxton, and Fiksel 2013).

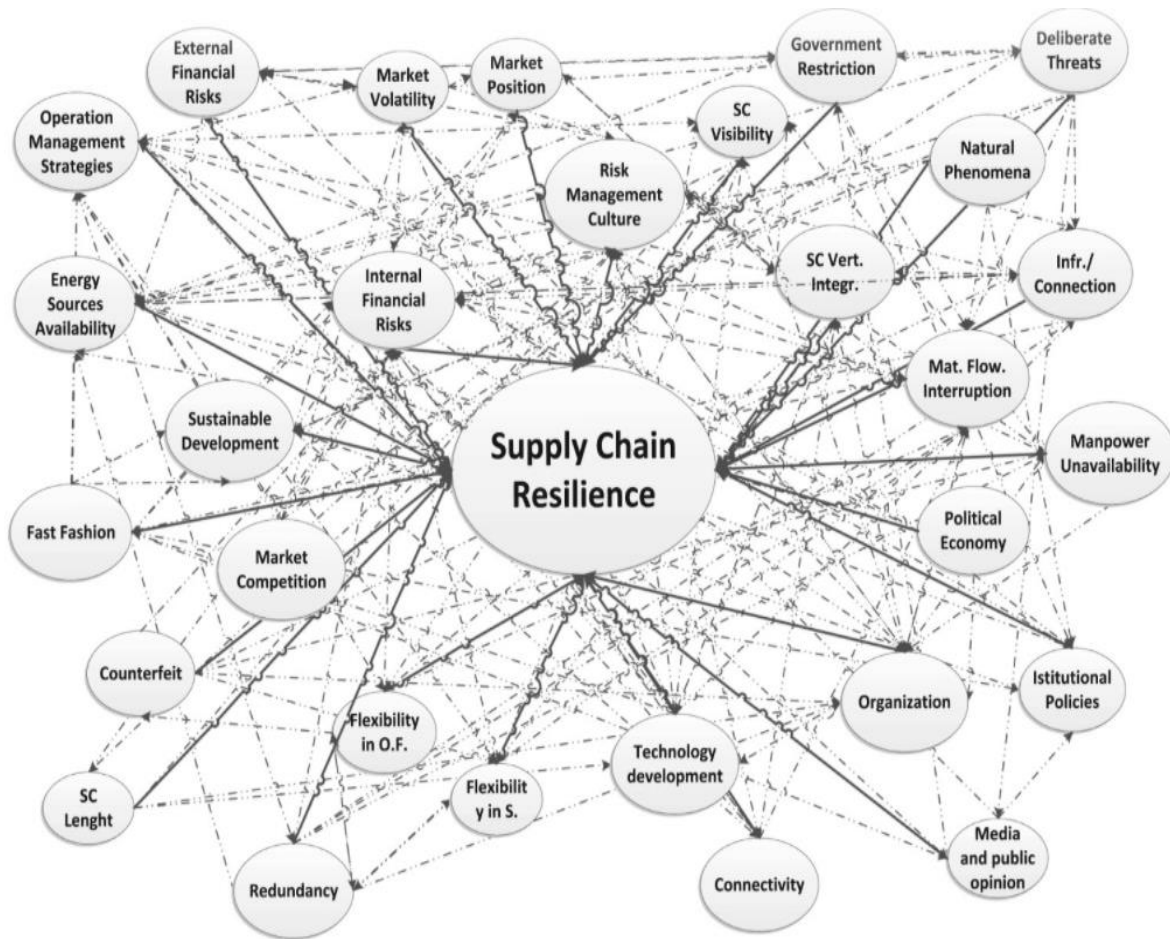


Figure 19 Cognitive map of Supply chain resilience. Source : (Chunsheng,2019)

Ponomarov and Holcomb (2009) define resilience as follows. (1) the degree of change a system can undergo while maintaining structure and function. (2) The system's ability to self-organize without external disarray or coercion. (3) A system's ability to learn and adapt in response to perturbations. It is defined as "the adaptive capability of the supply chain to prepare for unforeseen occurrences, respond to interruptions, and recover by preserving continuity of operations at the required level of connectedness and control over structure and function" in the article (Ponomarov and Holcomb 2009). According to

Melnyk et al. (2014), supply chain resilience is the ability to withstand and recover from disturbances. Companies may not be able to afford both resistance and recovery, according to the paper. It guarantees the company sources from numerous vendors, preventing interruption. According to the paper, supply chain resilience is something that must be invested in. It also suggests eight ways to boost resilience's impact on avoidance, containment, stabilization, and return. The tactics include indirect investment, discovery, information, supply chain design, buffers, operational flexibility, security, and preparation, respectively. Brandon-Jones et al. (2014) adopt a resource-based approach to explore how and when firms may build supply chain resilience. Resources can be pooled to generate capabilities, according to the resource-based view. A complicated supply chain helps an organization to optimize the effects of visibility, they claim. The article's three key contributions are that they demonstrate the impact visibility has on disruption recovery. They extend resource-based supply chain visibility analysis. Finally, they emphasize the need for greater supply chain risk management theory. Naghshineh and Carvalho (2020) say that additive manufacturing can boost supply chain responsiveness by increasing product production rate.

3.9.1 Supply chain vulnerability

Due to globalization, supply chains are becoming more and more complex (Dejonckheere,2004). Research into supply chain resilience must take a comprehensive approach in order to understand the dynamics of turbulence and complexity (Pettit et al., 2010). Resilience and risk management are two distinct approaches to managing supply chain vulnerabilities and responding to and recovering from future disruptions (Juttner & Maklan, 2011 ; Ponomarov & Holcombe, 2009). Despite the fact that not all risks can be avoided, proactive measures like supply chain resilience management have the potential to complement and enhance traditional approaches to risk management. Resilience to supply chain disruptions, according to Pettit et al. (2010), is based on how to handle elements such as globalized supply chains, specialized manufacturing, increasing outsourcing and increased unpredictability of demand. Even though some disruptions can present opportunities, supply chain managers are becoming more aware of the risks they face. Supply chain resilience is an important consideration when trying to improve supply chain performance in the face of these threats.

3.9.2 Supply chain resilience Capability

According to Tang (2006), nine supply chain methods are needed to operate well in both regular and emergency situations: deferral, flexible supply base, make-and-buy, economic supply incentives, flexible transportation, revenue management and silent product rollover. They argue that supply chain resilience improves when capabilities improve and vulnerabilities reduction (Figure 19), thus offering two criteria for intensive concentration: vulnerability and capability. Unbalanced resilience refers to decreased

profitability and excessive risk in the supply chain. Supply chain resilience has three major dimensions: proactive capability, reactive capability, and supply chain design quality (Chowdhury and Quaddus, 2017). These three fundamental dimensions have twelve sub-dimensions. According to Chowdhury and Quaddus (2017), the supply chain resilience scale better predicts supply chain operational vulnerability and performance. Supply chain resilience framework is the initial to illustrate resilience in terms of metrics (Pettit, 2010). According to Pettit (2010), the framework recognizes the need to balance managerial talents with the intrinsic supply chain architecture and environment. The author identified 14 key qualities that contribute to supply chain resilience. It provides for detection of existing supply chain operations, possible transition phases, and vulnerability areas. While factories definitely prefer to be both capable and vulnerable, it is more likely that companies will be a mix of both. Given asset goals and competitive factors, organizations should prioritize where to invest limited resources.

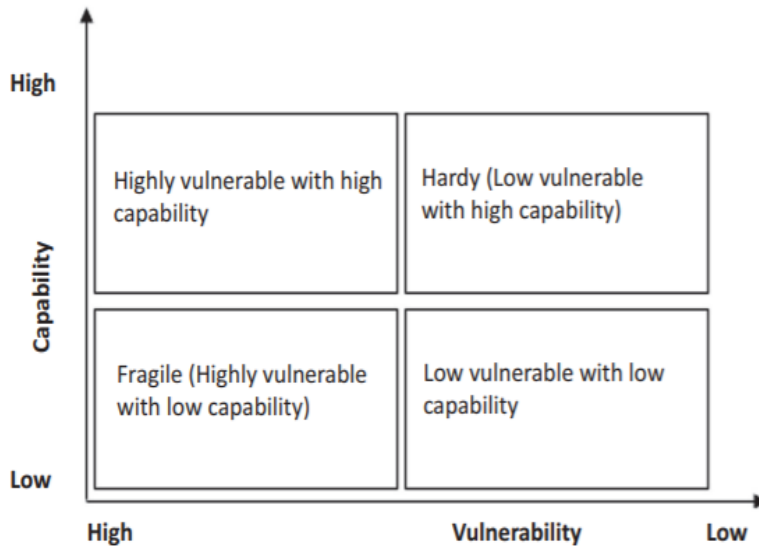


Figure 20 shows the matrix for capability and vulnerability, which characterizes conceivable position that companies might find itself in with regard to changed levels of these characteristics (Source : Rusi,2019).

3.9.3 Improving supply chain performance through supply chain resilience

COVID-19 has a lot to teach us about supply chain management, but we've narrowed it down to three main takeaways because of how frequently they occurred. Emergence of supply chain localization, agility and digitization amid the financial crisis has been widely discussed (Ivanov, 2020). Recent years have seen a rising importance in the role firms and their suppliers play in affecting environmental, social and

economic outcomes. Constraints on economic and social growth are widely accepted as necessary to prevent environmental degradation (Ruiz-Bentez, 2018). The pandemic of COVID-19 has disrupted numerous value chains around the world, particularly in the context of sustainable supply chains. As a result, these interruptions have a substantial impact on revenue and growth as well as return on investment and procurement strategies, materials supply and supply chain integration. The immediate significances of supply chain components, such as procurement, production, distribution, or logistics, are sparked by looking at sustainability from a border viewpoint. Since a result, supply chain management has become increasingly integrated, as some supply chain activities have become interconnected. Supply chain managers should rethink their strategy and procedures in this regard. To put it another way, firms are struggling to construct supply chains that are significantly more resilient than Productivity (Carvalho,2020). A post-crisis climate exacerbated by the Corona virus necessitates a new approach to supply chain mapping that is more resilient. Researchers and practitioners can better comprehend this relatively new phenomenon by identifying and utilizing a variety of theoretical lenses (Ivanov,2020). You can use this information to understand how sustainable procurement implementation is affected by other factors, such as the impact of digitalization and online retailing. To better understand how sustainable procurement impacts performance, we can additionally examine environmental, financial, social, and broader business metrics.

Localization

Global supply chains, particularly during COVID-19 supply chains became fragile because of dependency heavily on a particular region for production ,face mask crisis in the beginning of the outbreak is a great example. As global supply chains were challenged, local sourcing became increasingly vital. Supply chains are not resilient for political, financial, and health reasons (Ivanov,2020). Because the virus originated in China, the US prohibited Chinese exports of goods and resources. Business and health concerns included the risk of virus spread via packaging, goods, and citizen travel (Moosavi, J. and Hosseini,2021). During the pandemic, localized production became necessary. Localization is defined as the geographic location of a company's physical facilities and the activities that take place there. Localization may help solve a greater global issue. Localization of supplies may help improve supply chain resilience (Karmaker,2021). Localization of activities such as purchasing, manufacturing, and R&D is critical for organizations to remain competitive. Prices vary widely around the world, and tariffs account for a large portion of product expenses when trade across national and/or regional borders (McMaster,2020). Localization is the act of internalizing decision-making duties and partial insourcing of activities that were previously outsourced for various reasons (Spieske,2021). Localized end-to-end supply chains can be seen as a strategic trade policy in some cases. Supply chain localization is driven by

developing and safeguarding proprietary technologies, increasing employment and investment, lowering unexpected outsourced expenses, and reducing supply chain risks (Kumar,2020)

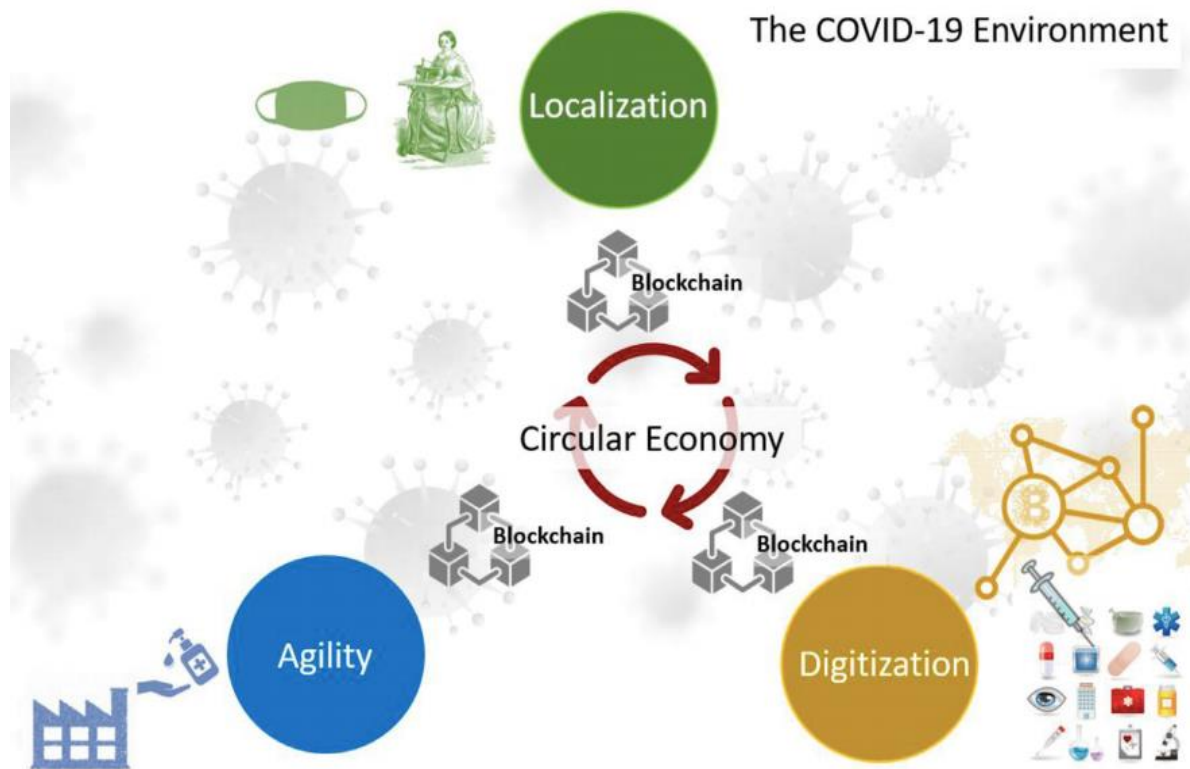


Figure 21 Synchronic supply chain network to avoid future disruption. Source : (Fabbe-Costes,2021)

The advantages of a sustainable supply chain can also be acquired by localization. A primary example is reduced long-distance transportation, which is a major greenhouse gas emitter (Tarigan,2021). Through reshoring or insourcing, supply chain localization can take place. Because of the lower travel distances and the quicker response times provided by nearby enterprises, localization may be deemed more resilient than outsourcing (Baral,2021). As local resources and materials for sourcing and replenishment become scarce, the scope of localization is constrained. Nevertheless, it makes use of waste generated in the area to create new products that can be remanufacture, reused, refurbished or reclaimed and efficiently delivered to locals. For example, the state government and academic institutions in Massachusetts, the United States, collaborated to quickly deliver medical staffs with personal protective equipment (PPE). When a global crisis (war, drought,famine) or epidemic occurs, it is important to have the ability to respond in a localized manner (Ivanov, 2020).

Agility

The COVID-19 epidemic emphasized the need for businesses and supply networks to be more agile, similar to the benefits of localization. Supply chain literature defines agility as a strategy for meeting customer needs while also being flexible enough to adapt to changing market conditions and seize opportunities as they arise (Al Humdan et al., 2020). Also known as the capacity to recognize and grab market opportunities quickly and surprise (Agility requires market-sensitive knowledge, shared information on demand and the leveraging of partner's integrated capabilities to resolve demand needs.). In a nutshell, agility is the ability to respond quickly, effectively, and flexibly to shifts in demand (Butt,2021). When demand or supply changes unexpectedly, the supply chain needs to adapt swiftly (Rajesh,2021). In order for an agile response to be successful, there must be agile partners both upstream and downstream of the focus company to provide responsiveness, flexibility and additional capacity (Shen,2021). For occurrences with a low probability of occurrence, a reactive response is adequate; proactive responses necessitate far more capacity in preparation, such as inventory, to increase resilience and reduce waste. Building adaptability is one way to combat problems like the COVID-19 epidemic. Organizations that are nimble in their approach are better able to seize new possibilities and overcome obstacles (Lotfi,2019). In the manufacturing industry, agility is defined as the capacity to see changes as opportunities and seize them. A responsive firm would be able to adapt to shifting market conditions and emerging client demands. Agile capability can be achieved by manufacturers through the integration of their business components or by simply having flexibility in areas such as manufacturing, personnel, and the company. Detecting and acting on opportunities is a key component of agility in the supply chain management field. That example, if a company can "tap into the pool of external knowledge held by supply-chain partners" while "creating goods that are more aligned with the firm's sourcing and production capabilities," it can improve its agility to identify and respond. It is important for a company's supply chain to be as agile as possible, which means that information and digital resources must move freely across the entire chain. Developing the right information processing capabilities can improve operational agility (Hossain,2020). Agility is the capacity to quickly and easily make operational changes in an organization's processes, as well as customer agility, entrepreneurial alertness, and digitized reach (Apuzzo,2020). There was a dramatic increase in demand for products and services following the COVID-19 crisis. Some needs have shrunk to a mere fraction of what they were, while others have skyrocketed. A few examples of these shifts are the differences in the sizes of food, toilet paper, and cleaning supplies in industrial versus consumer packaging, autos versus delivery trucks, industrial petroleum versus home heating and cooling fuels, and air travel versus technological meetings (de Sousa Jabbour,2020). Materials and product sourcing become more difficult because of the global supply's

brittleness and the need for flexibility. Agility here refers to the capacity to respond rapidly, flexibly, and cost-effectively to a need. When the Chinese authorities learned of early COVID-19 instances in their nation, they shut down a number of domestic manufacturers as a precautionary measure. Orders from throughout the world could not be fulfilled by Chinese producers. In order to meet the huge demand for hand sanitizers, local producers had to immediately adapt their production lines (Velayutham,2021). As the COVID-19 virus spread worldwide, the necessity for supply chain agility became more evident. Table 4 summarizes the agility of the world's leading manufacturing corporations to overcome the impact of COVID-19 battle.

Companies	Industry	Before COVID-19 manufacturing	During COVID-19 manufacturing
Ford	Automobile manufacturing	Vehicles	Respirator and ventilators
Tesla	Automobile manufacturing	PV Cells and vehicles	Ventilators
Airbus	Aircraft manufacturing	Aircraft	Ventilators
Zara	Fashion	Apparel	Surgical masks
Bacardi	Alcohol	Rum	Hand Sanitizers
Gucci	Apparel	Clothing	Masks
Indian Ordnance Factory	Defence	Defence equipment	Ventilators

Table 4 World’s leading manufacturing companies before and during COVID-19.(Gereffi,2020)

Low supply levels of high demand items necessitated organizations and supply chains to be more flexible. That is why agility has evolved as a more resilient management technique for firms than cost-focused lean supply chain management concepts (Buheji 2020).

Digitization

Digitization is defined as the underlying reasoning behind the social isolation and separation of valued commodities and services in order to preserve some sectors of the economy, promote social interaction, and facilitate online purchases (Iivari,2020). Digitization entails representing, processing, storing, and transferring as much matter, energy, and information as possible. Traditional business strategies are being reshaped by digital technology as modular, distributed, cross-functional, and global business processes that enable work to be performed across time, space, and function boundaries (Akram,2020). Through social media and social networking, these technologies are also redefining the structure of social relationships for both consumers and businesses. Visualization is the capacity to visually represent business data. A digital economy is one that is built on the digitization of information and its associated information and communication infrastructure (Nandi,2020). This new economy entails both problems and opportunities, necessitating the development of capabilities in order for companies to overcome the

hurdles imposed by digital transformation, seize the opportunities that come with it, and adapt to this new context. The majority of businesses are battling for digital rights, and they know that digital is an incredibly effective tool for developing brands and strengthening relationships, owing to its unique capacity to engage individuals and communities (Cheshmehzangi,2021). Digital capabilities can be thought of as services provided from one system to another via value-creating provider-user interactions; they can also be thought of as a digital consequence or service. Digitization can enhance a business's internal capability to serve customers with real-time information (Vanany,2021).

3.9.4 Viable supply chain model

This section presents a model of a viable supply chain. At the outset, an ecosystem of supply chain agility, resilience, and survivability is laid out (Fig. 22). The Viable supply chain (VSC) model addresses value-adding networks that are dynamically adaptable and structurally customizable.

(i) respond quickly to positive changes, (ii) be resilient to uncertain events and recover from disruptions, and (iii) survive long-term, global disruptions by adjusting capacity utilization and allocation to demand in response to internal and external changes in accordance with sustainable development to ensure the provision of goods and services to society and markets in the long run. (Ivanov, 2020).

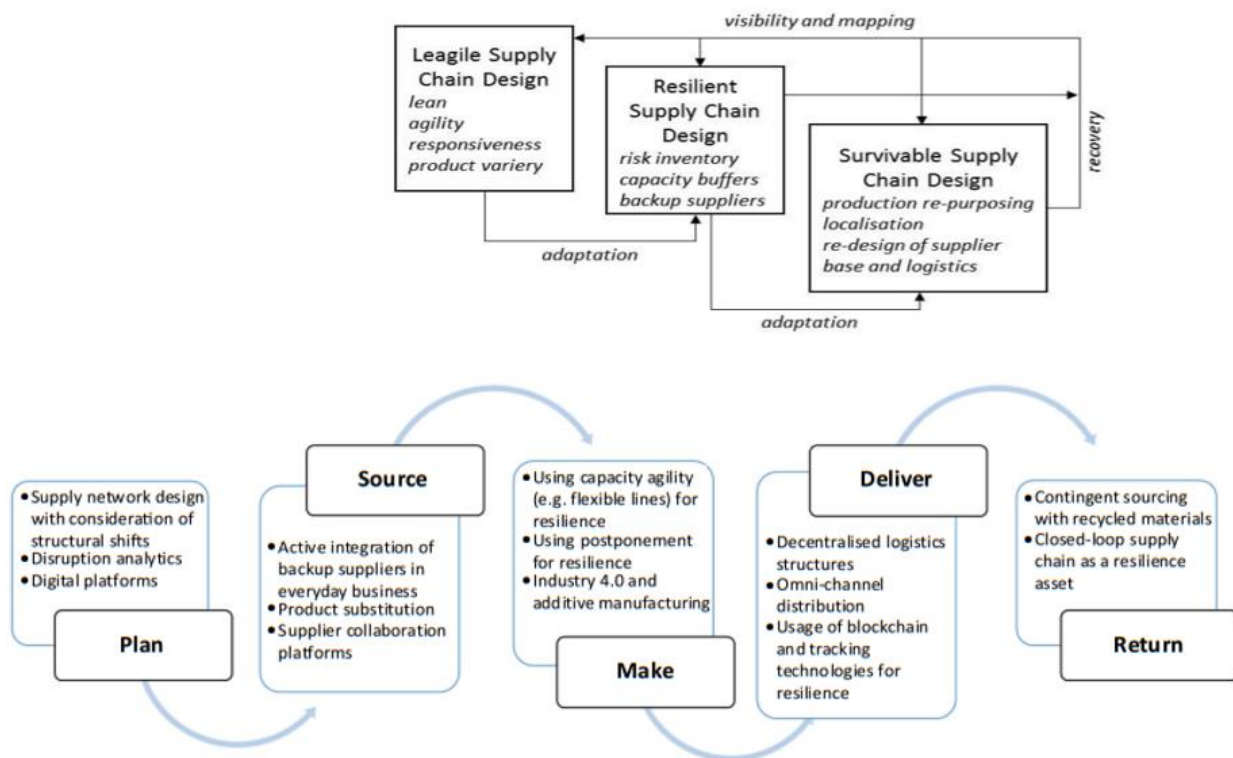


Fig 22 : Viable SC model (Source : Ivanov, 2020)

Digital technologies and Industry 4.0 are another field of research that is becoming increasingly evident at the junction of value creation and resilience. Data analytics, additive manufacturing, sensor technology, radio frequency identification (RFID), and T&T (Track and Trace) systems are all examples of digital technology's contributions to SC resilience. These technologies all help to improve demand forecasting and supply chain visibility and transparency (Ivanov et al., 2019; Brintrup et al., 2020)

3.9.5 Certifications

Certification helps corporations to validate and promote their sustainability Promise (Byrne,2004). Certification confirms an organization's criteria to maintain a specified criterion. As customers become more knowledgeable, they demand greater accountability and transparency (Denning,1977). This was true in Europe. The ISO is based in Geneva, Switzerland. They developed a set of industrial and commercial standards for products, services, and systems. Quality, safety, and efficiency improved as a result. This technique was quickly adopted in many industrialized European countries. Textile firms and consumer organizations conduct tests to ensure our clothes and materials are safe, comfortable, and colorful. This is called textile testing. Testing allows firms, consumer groups, and governments to ensure textiles are safe, of high quality, and that customers get what they paid for (Sunyaev,2013). Textile items are made and sold globally. External parties are frequently used to ensure supply chain sustainability since they may bring expertise that many organizations lack or develop internally at a high cost and time. This can help companies, create an organized method for the sector, and show customers that this product is more sustainable than others. The following are the writers' top three most popular certificates in Norway (Balci2003). This is referred to throughout the findings and discussion sections. The Nordic Swan (Svanemerket) is the official Nordic environmental certification standard. Working for sustainable water and resource use, biodiversity protection, and chemical safety. They monitor the entire supply chain and have many requirements to meet to receive the Nordic Swan mark. The Nordic Swan also provides a network of decision-makers with advise on how to practice more environmentally friendly procurement (Nordic Swan 2020). Bluesign® is an international third-party certification system that combats harmful chemicals in textile manufacturing. Goal: a safer and more sustainable environment. To be approved by Bluesign® means that their criteria and a complete list of substances have been monitored. Assuring maximum environmental and human safety throughout manufacturing (Bluesign®, 2020).Research by Scruggs (2013) found that using Bluesign® could be a good way for smaller companies to ensure that their manufactured goods are safe, without having to invest in more workforce and expertise. As well as

force the sub-suppliers to improve their practices in sustainable aspects (Bluesign® 2020). Oeko-tex® is another international third-party certification standard for textiles.



Figure 23 : Certification authenticity to implement Economic, Social and environmental aspect of sustainability in fashion industry. Source : (Rametsteiner,2013)

One of their standards is SteP by Oeko-tex®, which tests and certifies working environment, facilities, safety, and resource management. Reducing the carbon footprint and using chemicals responsibly are all components of environmental monitoring. (Oeko-tex® 2020).

3.9.6 Traceability

Traceability refers to the ability to track all processes from the procurement of raw materials to the production, consumption, and disposal of a product in order to determine "when and where the product was manufactured by whom" (Galvez,2018). As a result of improving product quality and increased safety awareness in recent years, traceability has gained in relevance and has moved into a wide range of areas, including agriculture, manufacturing, and food processing. Jarlgaard and Drinkwater developed the blockchain in the fashion industry by looking beyond sustainability to craftsmanship and educating consumers on the layers of complexity involved in bringing a product to market. The blockchain in the fashion industry can help shift the mindset away from throwing products into landfill and toward

appreciating the value of beautifully made items, which can help reduce waste (Boumans,2021). The goal is to offer firms and customers with knowledge and assurance that the product's whole value chain will be sustainable in the long run. Markus Hamerstad created this graphic (Fig 24), in which every aspect of the supply chain, from raw material supplier selection to finished goods delivery, can be tracked using blockchain technology.



Figure 24 : Clothing raw materials traceability by using Blockchain (Rusinek,2018)

According to Martine Jarlgaard, a London-based designer, "when we consider outsourcing now, we've acquired a significant distance from how things are manufactured. Technology will let us link with the people and places involved, and this information will raise customer expectations, putting additional

pressure on large corporations to reach sustainable procurement goals in the fashion industry (Bullón Pérez, 2020)."

3.9.7 Application of blockchain to meet the challenges in fast fashion

As previously said, overproduction of products causes environmental and social issues. By minimizing, reusing, and recycling the resources involved, blockchain technology can help reduce some of these issues (Ahmed,2021). First, blockchain can help decrease overproduction. As a result, the supply chain for quick fashion is linear. Due to the linear structure, only two adjacent nodes can share information, so information about end-customer demand must be distorted (primarily for buffer consideration) when traveling upstream providers (de Boissieu,2021). It generates a lot of waste from overproduction and transit inventory. To lessen the bullwhip effect, supply chain partners must be able to freely communicate. However, lack of trust (Cai et al., 2010), lack of common vision among supply chain members (Li & Lin, 2006), and lack of trust in information exchange in multi-tier supply chains make this challenging (Kembro et al., 2017). Because blockchain technology can provide a decentralized, trust-free network to share asset databases peer-to-peer (Yang et al., 2018), it can provide a supply chain with security, speed, and scale of data exchange among all supply chain actors (Wang et al., 2019). So, in the pre-production stage, blockchain technology can help supply chain partners collaboratively forecast demand (Dujak & Sajter, 2019). As a result, the amount of production and packaging in the entire fast-fashion supply chain can be reduced (Wang et al., 2019). Thus, production waste can be greatly avoided. The distributed, decentralized network may also securely transmit data such as sales, stock, and post-production transition, allowing all supply chain actors to adapt their operations, inventory, delivery, sales, and reorder schedules accordingly (Mylrea & Gourisetti, 2017). As a result, the entire supply chain can reduce postproduction inventory.

Table 5 : Socio,economic and environmental challenge to confront in RMG industry by adopting blockchain (Tripathi,2021).

Challenges	Potential blockchain solutions
Product economics of fast-fashion products and supply chain	a) In the pre-production stage Enable the establishment of a decentralized, trust-free network to peer-to-peer share the asset database and collectively forecast demand, reducing the bullwhip impact. b) In the production stage Provide a secure, fast, and large-scale data interchange among all supply chain actors to reduce channel inventory. c) In the post-production stage

	Fast fashion supply chain efficiency can be improved through reducing time, costs, and waste of fashion products in transit, as well as in the production and packing of such products.
Environmental and social problems related to sustainable supplier selection in the preproduction stage	Provide a better option for evaluating and selecting the right suppliers. Program to automatically trigger actions (including supplier verification and certification) Supplier verification can be conducted, recorded, and accessed quickly by all blockchain nodes. As a result, a blockchain-based supplier selection process will be easier, more efficient, and effective in the pre-production stage
Environmental and social problems related to suppliers in the production stage	Blockchain record and traceability system can support the three pillars of sustainability by monitoring and tracing real-time occurrences in terms of environmental and social responsibilities. Audit the quality and safety of the use of chemicals, water, and land during fashion production, (2014), besides auditing manufacturing from biological sources and technical fibers derived from nonrenewable chemical resources Detect working conditions and workers' status by collecting environmental data such as light, humidity, and temperature and working hours. These data can be used to analyze, evaluate, certify, and recertify whether the suppliers have met the ethical standards and requirements.
Environmental and social problems related to fast fashion in the post-production stage	<ul style="list-style-type: none"> • Blockchain technology can verify, record, track, and authenticate the production and usage history of the fashion product which can be resold, rented, and donated to extend lifetime after washing, and brand auditing. • Through blockchain verification and authentication, materials from acknowledged to be at the end-of-life can be reused and remanufactured into other industry, thus optimizing the utilization of fast-fashion products and minimizing landfill waste amounts.

Product recycling and after-sales service management are responsible for product recycling. Recycling, reuse, and leasing can not only minimize waste but also cut raw material consumption (Patelli,2020). Using a blockchain-based system, manufacturers may readily identify recyclable and non-recyclable products. This application can also help with environmental problems, as recycling and disposal are closely intertwined (Hastig,2020). A circular supply chain's sustainability evaluation management is critical. It entails evaluating aspects of the environment, economy, and society. The data collected throughout the product life cycle is used to analyze an enterprise's commercial qualifications as well as its sustainability responsibilities (Bucci,2021). Sustainability assessment can help manage energy, waste, and environmental quality. For example, energy usage can be tracked, analyzed, and assessed, as well as energy conversion and recycling. The data on consumption and output emissions can be easily shared and combined to assess a product's environmental performance throughout its life cycle. Using a blockchain system, users may assess the environmental implications of waste emissions throughout the product life cycle (ErsesYay, 2015). The studied results help make judgments and strategic plans for waste management (Khoo, 2019). A circular fast fashion supply chain must handle materials reuse. This approach involves reusing textiles from old clothes. Some fabrics, for example, can be recycled and reprocessed into new garment materials or materials for other items (such toiletries), while others are better suited for industrial usage. It is possible to classify and identify materials through reuse management. The user layer includes suppliers, manufacturers, logistics companies, retailers, and

consumers (Mahyuni,2020). To collaborate on decisions ranging from new product designs to inventory optimization and marketing tactics, the first four parties can use a blockchain technology(Fig.25). They can also identify qualified partners and assess their supply networks' and production processes' environmental consequences. Manufacturers with established logistics and sales channels are both retailers and logistics organizations. In a circular supply chain, they can connect directly with suppliers upstream and customers downstream, allowing for better data sharing and faster market response. Consumers can make purchasing decisions by inquiring about product information such as certification and related environmental protection information via various applications. (Sandhiya,2021).

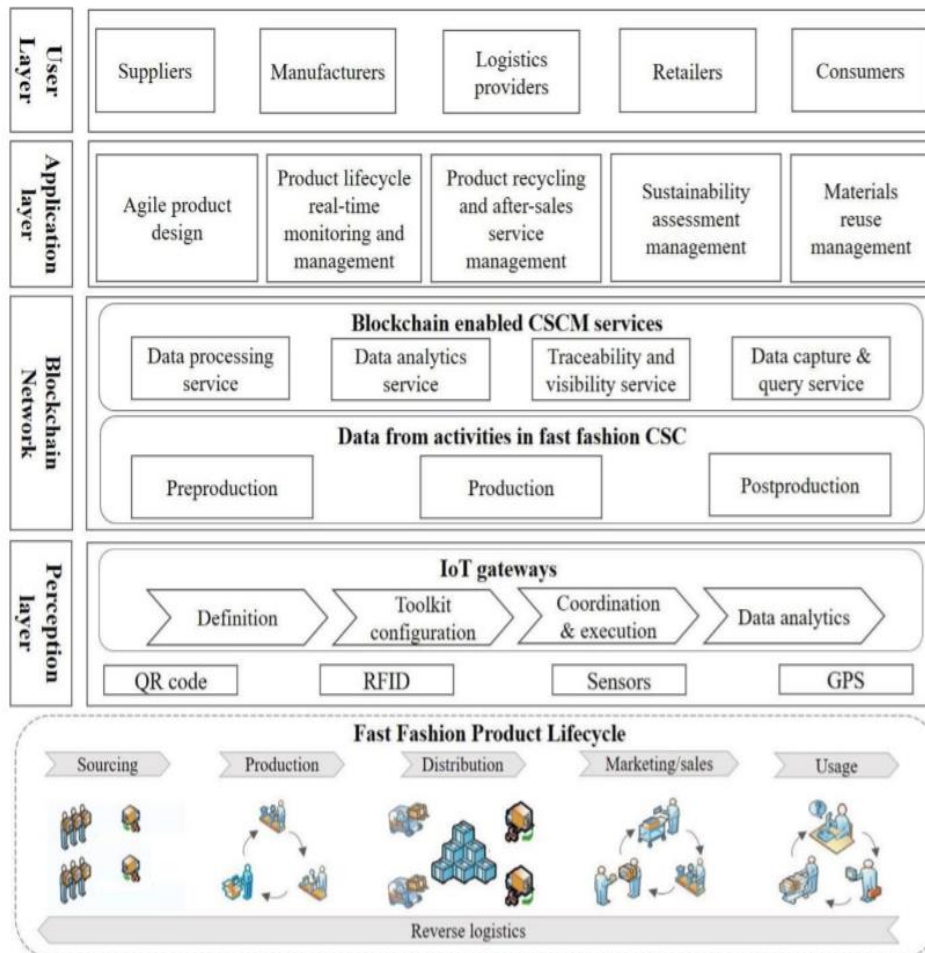


Figure 25 System architecture of blockchain-enabled Circular SC.Source : (Rajak,2021)

3.9.8 Product Life extension

Rather than focusing on volume or following the trend of fashion, the Product Life-Extension business strategy focuses on longevity. Manufacturers will need to build products that can be upgraded, extended, and eventually recycled. Even fast-fashion giant H&M admits that "wearing your clothing for as long as possible is the best option."(Periyasamy,2017) Many companies currently urge their customers to retain their garments longer. With “buy less, fix more” as the motto.Nudie Jeans , a famous denim brand take a different approach. They repair torn jeans for free in their own repair shops, of which there are now 20 globally (Muthu,2017). In 2015, 21.331 jeans were repaired (Amutha,2017). Wherever possible, Nudie sends their customers a free repair kit that includes “2 Denim Patches, 1 Black Denim Patch, 1 Iron Patch” as well as a repair kit booklet and a thimble (Fig 38). Customers who trade in their old jeans get a 20% discount on new ones. Nudie either recycles or repairs and resells old ones (Zhang,2021). Rapanui Clothing has also set up a freeposting scheme to encourage people to return old garments. “You can return items for store credit even if they are damaged or Consumer have lost their receipt. (Periyasamy,2017).



Fig 38 : Repair service pack of Nudie Jeans. Source : (Periyasamy,2017)

3.9.9 Drivers of sustainable procurement in context of COVID 19

For Elkington (1999), markets, value, corporate governance, transparency, and partnership are among the most important drivers of sustainability (Wahga,2018). Increased awareness of the potential negative impact of the international supply chain; increasing resource scarcity and its rising costs; public and activist (stakeholder) pressure for greater corporate responsibility and accountability; an increasing need for competitiveness through cost efficiency; and a desire to reduce environmental impacts (Todeschini,2020). A number of internal factors may influence (or constrain) the changes necessary to

embed sustainable procurement in an organization: mission, vision, and objective; senior management attitude; CSR policies; risk management policies and processes; performance measurement mechanism; and resource availability (CIPS 2012a). Pressure on businesses can be particularly successful when coming from stakeholder groups such as environmental campaigns, non-governmental aid organizations (NGOs), and even the local community as well as end consumer awareness (Moktadir,2018).

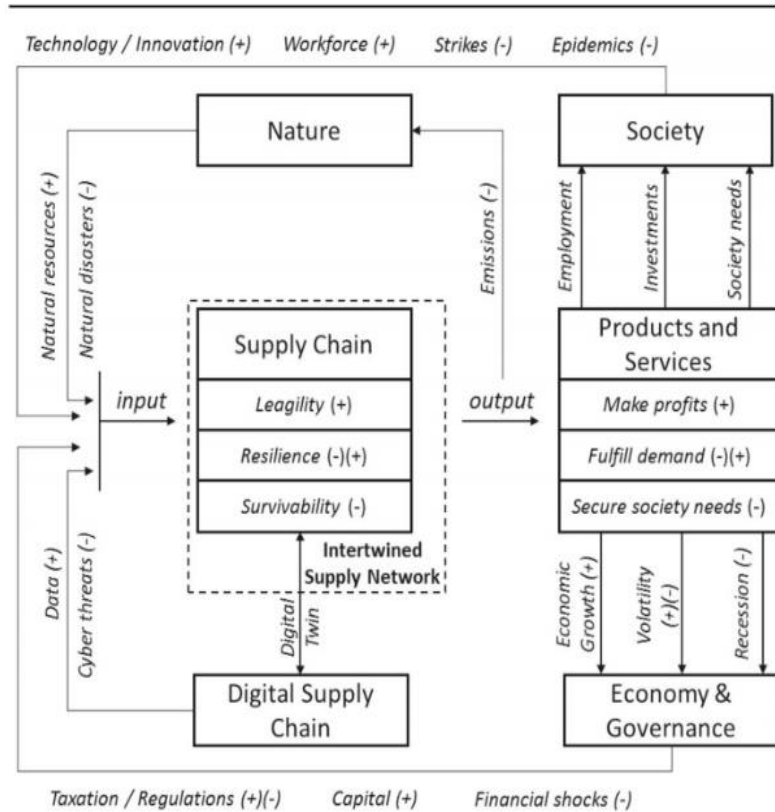


Figure 26 :Driving factors to create resilience SC in COVID 19 environment. Source : (Ivanov,2020)

Since people are becoming more aware of and concerned about environmental and social issues, corporations who reveal more information about their operations are seen as more trustworthy by the public, according to Hughey and Sulkowski (2012) As a result of these and other factors, the adoption of environmentally friendly practices is becoming more widespread over the world (Zhu and Sarkis 2004). Environmental rules and subsequent actions by businesses can offer competitive advantage, according to Porter (1991). (Golan,2020).

Chapter 4.0 : Research Methodology

4.1 Chapter Introduction

Methodology is a term used to describe the way in which we approach problems and search for solutions" (Taylor, Bogdan, and DeVault 2015). Learning methods and standards are examined as part of this fictional research. Most of the time, it contains concepts such as a worldview or hypothetical model, as well as stages and quantitative or qualitative approaches to problem solving (Igwenagu 2016). In this chapter, we'll go over the methods in great detail. This chapter explains the research strategy, data collection methods, and data analysis methods. An overview of the study's philosophy is followed by a discussion of the research objectives, design, strategy, case-selection and case-descriptions as well as data collecting and analysis.

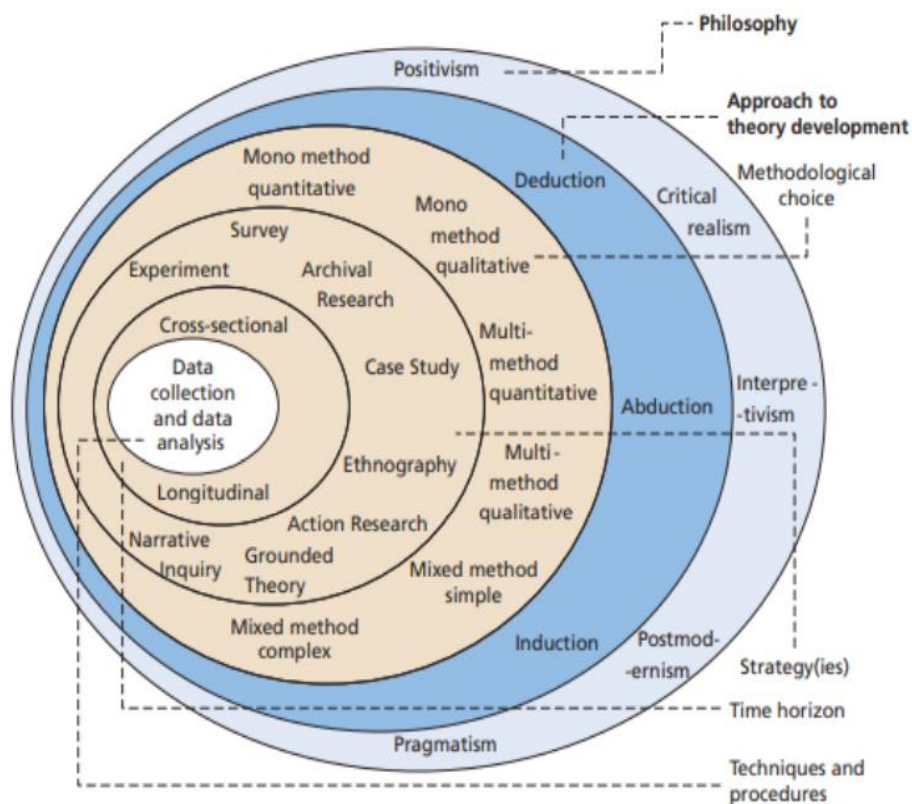


Figure 27 The research onion. Adapted from (Saunders, Lewis, and Thornhill 2009)

4.2 Research Philosophy

A researcher's research philosophy incorporates substantial assumptions about how the researcher sees the world. These assumptions will guide the researcher's research strategy and techniques (Saunders, Lewis

and Thornhill 2009). The main effect on a researcher's philosophy is likely to be their particular understanding of the link between knowledge and the method by which it is generated, albeit practical considerations should be acknowledged (Saunders, Lewis and Thornhill 2009). According to Saunders et al. (2009), a paradigm is a method of looking at social phenomena that can help explain them. Axiology question: "What is the researcher's view on the role of values in research?" Procedural and methodological question: "How can the researcher's view of values in research be achieved?" Saunders et al. (2009) added four research philosophies in management research: Positivism, Realism, Interpretivism, and Pragmatism (iv). Positivism is a study technique and strategy based on the belief that truth and reality are independent of the viewer and observer (Aliyu, et al. 2014). In order to express the importance and stress on impartiality, measurement, objectivity, and repeatability, a positivist investigator believes in the existence of intricacy and complexity that can be solved by reductionism. These scholars are realistic and objective in their analysis and vision of the cosmos. Positive researchers usually utilize quantitative, confirmatory, laboratory, nomothetic, and deductive methods (Olesen, 2004; Saunders, et al. 2009). When positivist is not the ontological point, the question arises of what alternatives to positivism exist. Given positivism's ontological standpoint, the alternatives are non-positivist ontological points of view. Recognizing that the observer contributes more to the establishment of truth and reality than the observer believes, some writers feel that the opposite of positivist research paradigm is rationalism (Goles and Hirschheim 2000). The idea that the researcher or observer creates reality or truth is one of rationalism's areas (Aliyu, et al. 2014). Ontological non-positivism is the interpretive paradigm. An interpretivist researcher believes there is no universal truth. This researcher interprets occurrences based on his/her own frame of reference. According to this researcher, impartiality and indifference are unachievable, and realism or practicality of backdrop is required. These writers share a subjective or relativist worldview. Field experiments, idiographic experiments, exploratory analysis, and qualitative analysis are commonly utilized by interpretivist researchers and scholars (Saunders et al, 2009).

Assumption	Interpretivist	Positivist
Ontological: Nature or reality	Reality is subjective.	Reality is objective.
Epistemological: Relationship of the researcher and the issue being researched	Subjective involvement of researcher that affects the issue being researched.	Researcher is independent from what is being researched: that is why it is value-free.
Axiological: Roles of values	Scientific study is value-laden and biased.	Scientific study is value-free and unbiased.
Rhetorical: Language of research	Usually informal and qualitative terminologies are used.	Formal and quantitative terminologies are used.
Methodological: Process of research	Based on idealism, uses a number of methods to obtain different perceptions of the phenomenon.	Based on realism, focus is on objective and hypotheses formulation.

Table 6 Interpretivist versus positivist paradigm. Source : (Shen,2021)

This study exhibits non-positivism and hence follows the interpretive research paradigm. Aspects of the research data represent the researcher's understanding and interpretation of the subject of sustainable procurement in the ready-made clothes business. To adopt sustainable procurement in the Bangladesh RMG business through circularity in the procurement process is an exploratory project that tries to better understand the subject 3BL literature.

4.3 Research Objective

Wacker (1998) claimed that research objectives may be divided into two categories: theory building and fact finding. The basic goal of theory-building research is to explain who, how, when, what, where, and why specific phenomena occur and what the consequences are. Theory-building research collects evidence to test an anticipated phenomenon. However, fact-finding research gathers evidence to discover relationships. Fact-finding research explains how and why certain events occurred. This master thesis is most like a fact-finding investigation. Data is collected to find out whether there are any ties that can help to understand the Why and How. The study also tries to explain why and how sustainable procurement works, as well as its implications.

4.4 Research Approach

According to Bryman and Bell (2015), there are two primary approaches to the relationship between theory and research: (1) deductive, in which the researcher develops one or more theoretical hypotheses and empirically tests them; and (2) inductive, in which the researcher's empirical findings and observations contribute to the development of new theory within a given theoretical domain. According to Saunders et al. (2009), researchers that employ an inductive technique are primarily concerned with comprehending the context or what is occurring. Because inductive approach researchers focus on comprehending the problem, which may be described in a variety of possible ways, the inductive approach has the advantage of flexibility and can be employed in a flexibly structured research (Saunders et al, 2009; Rose et al 2014). Deductive researchers employ a top-down method, with the theory serving as the starting point and the hypothesis serving to add or contradict the theory (Creswell and Clark 2007). In comparison to the inductive research approach, Saunders et al. 51 (2009) explained that the deductive research approach is about testing the theory through a five-step research process that includes the following steps: (1) developing the hypothesis from the theory, (2) breaking down the hypothesis into operational terms, (3) testing the operational hypothesis, and (4) examining the results of the hypothesis testing in order to confirm or modify the theory further. Deductive researchers employ a more structured framework than inductive researchers do (Wilson 2014), and deductive research methods are frequently adopted for quantitative research (Saunders et al, 2009; Rose et al, 2015). Rather of evaluating the proposed theory, this study attempts to construct it from the literature. As such, the study employs an

inductive research methodology. By implementing an inductive research approach, the study would place a premium on comprehending the research difficulties through a flexible study structure. Furthermore, there would be no need for speculation. The study's objective is to comprehend and explain the emerging issue of sustainable procurement in the RMG industry during Covid 19 and to build on the theory of sustainability based on the literature on the Triple Bottom Line (Economy, Social, and Environment) and sustainable procurement using data gathered from existing literature, statistical reports, and the websites of online retailers operating in the fashion segment to identify preliminary attributes.

4.5 Research Strategy

According to Bryman and Bell (2015), research methodologies fall into two categories: quantitative research (data gathering and analysis based on quantification) and qualitative research (descriptive detail and explanation). It is an inquiry process of knowing based on diverse methodological traditions that explores a social or human problem, according to Creswell (1998). The researcher creates a holistic picture, analyzes data, reports on informants, and conducts the study in nature. Qualitative research is based on observations and interpretations of people's perceptions of events in a natural setting (Guba and Lincoln 1994). 'We will never have a 'scientific' comprehension of human nature. The most we can do is find a truth that matters and opens new doors of understanding' (McLeod, 2001, p. 4). Dahlberg and McCaig (2010) claim that the employment of quantitative or qualitative research methods is not determined by the study strategy. The qualitative method of data analysis is popular, according to Straus and Corbin (1998). STRATUSS AND CORBIN This study uses a qualitative research method. The choice of qualitative research approach in this study is heavily influenced by the research problem. According to Morgan and Smircich (1980), a research method's suitability is determined by the social phenomenon being studied. Denzin and Lincoln (1994) define qualitative as non-quantitative processes and meanings that are not subjected to rigorous investigation, measurement (if measured at all). In other cases, especially in the social sciences, researchers may be more interested in discovery, insights, and interpretation than hypothesis testing (Merriam 1988). This study seeks to identify or obtain insight into the impact of sustainable procurement activities of the RMG business and analyze these findings.

4.6 Research Design

Designing research is an essential element of ensuring that it is done in a reasonable and effective manner. It ensures that the research problem is dealt with effectively. Data collection, estimation, and research are all included in this outline. Research design, according to David. J. Luck and Ronald S. Robin, is "the determination and statement of the overall research approach or strategy selected or the particular project. When it comes to planning, it's the most important part. The client's needs will be met if the design

follows the research purpose." In the words of Ahuja (2011), " Green and Tull define research design as "the specification of methods and procedures for obtaining the information required." "What information is to be gathered from which sources by what procedures" is specified by the project's overall operational pattern or framework. (Ahuja 2011, p. 3) It's possible to separate research design into two main groups. Qualitative and Quantitative data collection methods.

4.6.1 Quantitative research

Quantitative research is used to assess a problem by generating numerical data or data that may be transformed into actionable insights. It measures attitudes, sentiments, practices, and other identified characteristics, with larger population samples yielding better results. Quantitative research uses data that can be quantified. Quantitative data collection is far more organized than qualitative data collection (DeFranzo 2011). Data for quantitative research are usually collected by surveys (online, polls, and individual surveys in newspapers, magazines, and electronic media), personal interviews, group discussions, and observations (DeFranzo 2011)

4.6.2 Qualitative research

It is the primary goal of qualitative research to better comprehend human beings' experiences through a humanistic and interpretive strategy (Jackson, Drummond, and Camara 2007). The purpose of qualitative research is to gain knowledge and understanding of a problem setting through unstructured, exploratory research procedures that rely on small samples of participants. Accumulation and evaluation of information pertaining to historical events that is used to depict the causes, consequences, and trends that may be relevant to current or future events. Information is typically kept on file for future reference (Ahuja 2011). It is used to gain an understanding of underlying motives, conclusions, and inspirations, among other things. It allows participants to get insight into the problem or to generate ideas or hypotheses for future quantitative study. Qualitative research is also utilized to uncover the thoughts and feelings of the participants and to go deeper into the subject matter. In this qualitative study, the information needed is acquired from both primary and secondary sources, such as personal interviews, group discussions (such as those held in a focus group), documents, media reports, archives, and articles. The sample size is typically tiny. Those that take part in the data collection procedure are often chosen based on the type of research being conducted at the time (DeFranzo 2011). The exploratory research strategy used in this study is based on a qualitative research technique and is being pursued. In this study two different case companies have been observed and The qualitative approach was used for this research study because it allows for a more accurate analysis of the understanding of the managements' perspectives on the adoption of sustainability in those garment manufacturers. Using the two-case study companies, we will be able to collect information on its company case study, which will be focused on

3BL paradigms of sustainability and how to increase sufficiency by following 3R of circular economy principles to incorporate sustainability in their business model.

4.6.3 Reason to choose Qualitative research method

The goal of this research is to acknowledge the elements which oppose or ease the transition from linear to circular economy in the textile and apparel sector in Bangladesh by identifying current and desired interactions among the ecosystem's stakeholders. To achieve this goal, the following objectives were established:

- (1) To understand the circular economy ecosystem applied to the textile and apparel sector in Bangladesh
- (2) To identify the current interactions between the stakeholders
- (3) To understand the role of SC resiliency in the textile and apparel circular economy ecosystem
- (4) To determine the desired interactions between the sustainable drivers;
- (5) To identify the opportunities in moving to innovative technology to improve the supply chain network.

Nature of this research paper demands to get closer to the facts and findings to get a bigger picture. To find out the real problems in sustainable procurement and possible improvements based on these two companies, it was needed to have a close interaction with experienced industry informants sharing their experience and insights, to observe the facts from their professional experience towards achieving sustainable goal. However, only qualitative research would enable us to get inside the explanation and analysis those issues by get closer to the people who has knowledge and expertise in apparel and fashion industry.

4.6.4 Reason not to choose Quantitative research method

In order to write on this topic, the author first determine "why" and then explain How. This is because of the descriptive nature of the research. To find out "why," a thorough analysis of the facts, which can only be obtained by observation, personal interview, and discussion, is required. It is impossible to obtain information from surveys in the Bangladeshi apparel industry. Furthermore, they are not aware with the quantitative approach's application of this strategy in practice. As an example, surveys are often not completed by employees in the garment sector because they lack sufficient time and do not have access to the internet in the majority of circumstances. In general, quantitative research methodologies are unsuitable for the garment industry, and in particular for the types of studies that we conduct here.

4.7 Case study

Despite ongoing debates over the legitimacy of case studies and their limits in conjunction with other approaches, the case study method is becoming increasingly popular among researchers (Hyett, Kenny and Dickson-Swift. 2014). "A case study is the history of a previous or present phenomena, derived from

numerous sources of information," says Leonard-Barton (1990). Direct observations and systematic interviews, as well as material from public and private archives, can all be part of this collection. Since context is vital in a case study, any significant fact can be used as data, and Gerring, J. (2004) referred to it as "an exhaustive examination of a single unit for the purpose of understanding a larger class of (similar) units". Case study research is defined by Yin (1984:23) in terms of "an empirical inquiry that analyzes a contemporary phenomenon inside its real-world context; when the boundaries between phenomenon and context are not readily visible; and in which many sources of data are utilised." If the goal of the study is to answer "how" and "why" questions, Yin (2003) recommends using a case study design. This is because: (a) the behavior of those involved in the study cannot be manipulated by the researcher; (b) the research aims to cover contextual conditions because it is believed they are relevant to the phenomenon under study; or (c) the boundaries between the phenomenon and context are not clearly defined. A case researcher must decide whether to perform a single case study or a numerous case study in order to gain a deeper knowledge of a phenomenon (Baxter and Jack 2008).

4.7.1. Single Case Study

It is possible to describe a case study as an in-depth investigation of one individual, a group of people, or a unit, with the goal of generalizing to other units. There are two types of case studies: single case studies and multiple case studies. For single case studies, the attention is on one individual or group of people, while for multiple case studies, the focus shifts to several cases (Yin 2003). Case study methodology "explores a real-life, contemporary bounded system (a case) or many bounded systems (cases) across time, through extensive, in-depth data collecting using multiple sources of information.(Gustafsson,2017)

4.7.2 Multiple Case Study

Yin (2003) claimed that several case studies may be the best method for arguing either for differing results for predicted reasons or for comparable results across studies. Thus, the researcher can ascertain whether the findings are worthwhile or not (Eisenhardt 1991). However, Baxter & Jack (2008) highlighted that conducting several case studies may demand tremendous resources, making implementation costly and time consuming.

4.7.3 Cross-sectional design

It is necessary to gather data on more than one instance and at a single point in time in order to build up a theory of quantitative or quantifiable data in connection with two or more variables, which is then investigated to find patterns of relationship in order to conduct cross-sectional research design (Bryman and Bell 2015).

4.7.4 Experimental design

The researcher divides the population into two groups in order to affect the dependent variable in an experiment. The treatment is given to the investigational unit, which is then compared to a control group that does not get it (Gustafsson,2017). After the experiment, the dependent variable is measured to see how it compares to before and after. The implication is that the independent variable has been dealt with(Niinimäki,2020).

4.7.5 Reason for choosing multiple case study

Case studies are distinct from other types of research because of the researcher's idiographic method, which focuses on highlighting the case's unique features. Cross-sectional research, on the other hand, employs a nomothetic technique in which researchers aim to make generalizable claims. Establishing the focus is the first step in making a decision on whether to undertake a cross-sectional or a multiple-case study Cross-sectional designs are more focused with generalizing results without respect for the specific contexts of individual cases than are multiple-case studies, which focus on specific cases and their unique situations. Bryman and colleagues (Bryman et al, 2015). As a result, this researcher feels that this study was conducted using a multiple case study methodology. Snotex Apprels Limited and Square Textiles Ltd. are the two companies studied in this research. Both companies are based in Bangladesh, but they operate in different parts of the sector, which makes them distinct. As a result, the research meets its goals while also emphasizing the unique characteristics of each organization. With a large number of case studies, it will be feasible to compare and contrast the research questions of companies in the two leading conglomerate industry sectors. It was also stated that case study research should be encouraged because it may be used to build new ideas and concepts as well as to analyze and refine already existing theories, in addition to answering the "why" questions.

4.8 Research Method

According to Saunders et al (2009), research methodologies are concerned with how to acquire and interpret data. Methods of data collection include, but are not limited to, interviews, documentation, archival records and observations of physical objects, according to Yin (2003). The next sections of the chapter go into detail on the study's chosen research techniques..

4.8.1 Interview as the research method

It is common for researchers to be faced with the question of whether a survey, focus group, or interview will be the most appropriate form of primary data collecting for the research in question; for example. The major data gathering strategy for this project will be interviews. For this study, the qualitative research

strategy was the key factor in the selection of interview as the primary data collection method. When conducting a qualitative interview, the goal is to obtain information about the life-world of the person being interviewed and their perception of the occurrences they describe, according to Kvale (1983, p.174). Face-to-face interviews are the most popular method for gathering these descriptions (Opdenakker 2006). If you're looking for a complete answer, focus groups and interviews are the research methods most likely to provide depth of information that might be relevant and are also the most suited ways for resolving seemingly contradicting facts (Harrell and Bradley 2009). Personal interviews have been credited with a number of advantages by different authors and researchers, including: As an alternative to a questionnaire survey, it has the potential to generate a significantly higher response rate (Austin 1981) This means that no one else may help the reply in any way when they compose their answer to the question (Bailey 1987) three. it is highly adapted to the investigation of ideas, values and attitudes as well as motives (Smith 1975) the interviewer can observe nonverbal indicators and consequently, evaluate the validity of the respondent's answers through the use of these indicators (Gordon 1975)

In a closed fixed response interview, interviewees are asked the same questions and have to choose from a set of responses that are same for all participants. To put it another way, In light of the foregoing information, the semi-structured interview design has been chosen as the most appropriate method for this study's major data gathering instrument, the interview. In order to get the most out of a study, questions are carefully worded. Major questions were formulated as general statements that set the stage for following sub-questions and further investigation into the topic matter. This time, a semi-structured interview design was chosen over a structured interview because of the flexibility it allows in the approach of different respondents while keeping focusing on the same subject matter and region of data gathering. Even though they all work in the fashion sector, each organization has its own distinct history and conditions. It is thus possible to tailor the interview to the individual interviewee's circumstances and to go deeper if necessary, thanks to a semi-structured interview design.. When conducting an interview, the semi-structured interview method is preferred to a typical open-ended interview because it doesn't need to be tailored to each individual respondent. In light of the different nature and conditions of the organizations responding, this may prove difficult.

To investigate Bangladesh's RMG industry resilience in the face of the COVID-19 pandemic, the study technique proposed here is qualitative in nature. Case studies were used as a research method. According to Bryman and Bell (2007), a case study is one of the most commonly utilized research methodologies in a qualitative approach. Case studies are defined as descriptions of phenomena, past or present, that are supported by many sources. (Voss et al., 2002). From direct observation, methodical interviews, and public or private databases the case study can acquire data. The case study's ability to deal with a wide

range of evidence—documents, artifacts, interviews, and observations—is a hallmark of the method (Yin, 2003). A two-stage data gathering procedure was used in this study because case studies are known for having various sources of information. COVID-19 disrupted Bangladesh's RMG sector in the first round of study, thus online newspapers and websites were employed to gather information. With the advent of the Internet, online newspapers have become a modern repository of knowledge and data. In addition, archived news from online newspapers and websites gives consumers the freedom to browse at their own pace. Online newspapers also provide filed news, allowing readers to explore and read items according to their preferences and location. Researchers and academicians collect and translate information using data from daily newspapers and other advanced media sources. Researchers can now use the internet not only to gather data, but also to alter their views in order to better understand their own research projects and the questions that they raise. Tanackovic et al. (2014) did an investigation into the use of the daily newspaper, despite the fact that it is frequently used and regarded as unreliable and invalid. Using semi-structured interviews, we were able to get insight into the experiences and insights of those involved in the Bangladeshi garment supply chain. As part of this research, four interviews were conducted with the two case company, manufacturing and buying houses managers, including managers and executives at the mid- to top-level of supply chain decision-makers. This allowed us to get a good mix of insight from both the formal interviews as well as the informal ones. For this study, we consulted secondary sources such as company reports, fashion magazines, clothing websites, webinar, and so on. For two case company interview the time spent by each respondent ranged from 55 to 70 minutes. An investigation on supply chain resilience was conducted in each interview by asking the respondent a series of questions.

Interview No	Case Company	Organization Code	Informant	Informant Position and experience	Interview Length
1	1	M1	Inf1	Senior Operation manager (> 20)	55 minutes
2		M2	Inf2	Sr. Merchandiser (10-12)	48 minutes
3	2	M3	Inf3	Production manager (15-18)	65 minutes
4		BH1	Inf4	Merchandiser (>5)	50 minutes

Note(s): *M Manufacturer, BH Buying house

Table 7 : Interviews and information details

4.8.2 Research Validity and Reliability

When it comes to research, considerations of 'validity' have typically been connected with the use of quantitative research methods (Johnson 1997). Opinions on whether or not to apply the idea of 'validity' to qualitative research have been divided, however. Specifically, Johnson (1997) stated that validity in qualitative research refers to qualitative research that is believable and reasonable as well as trustworthy and thus defensible, and he proposed five forms of validity to be considered: There are several types of validity that can be applied to qualitative research, including (1) descriptive validity, (2) interpretive validity, (3) theoretical validity, (4) internal validity, and (5) external validity. There are also some strategies that can be used to promote and maximize research validity in qualitative research. To build on Johnson (1997)'s recommendation, this study used two types of qualitative research validity types and their respective techniques in order to promote the validity of this research. The types and strategies used in this study are as follows:

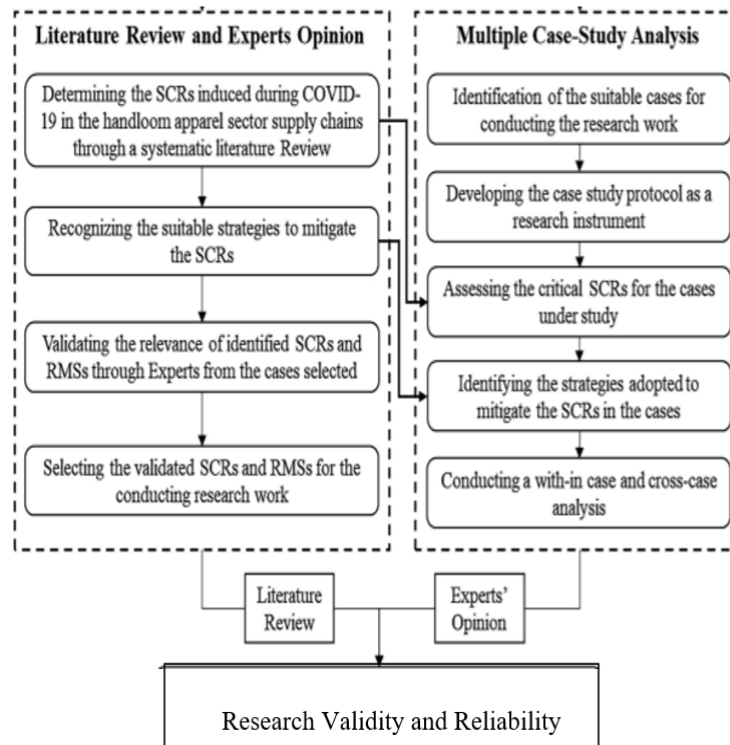


Fig 28 : Research validity and Reliability (Compiled by author)

It all began with a clear specification of the questions to be answered, followed by the selection of examples and the development of the research equipment. The next step in the research was to conduct field interviews and collect additional secondary data, which was then analyzed (with reference to the research questions). The findings of the research are then compared to the literature in order to identify parallels and differences. The study comes to a close with a summary of its findings and recommendations for further research in the area of sustainable procurement. Triangulation, according to Yin (2003), addresses both concept validity and reliability. Three types of triangulation are discussed: (1) data triangulation; (2) viewpoints on a single data set; (3) evaluations by different investigators; and (4) method triangulation (methodological triangulation). Using various sources of evidence is the first sort of triangulation addressed in this study. Secondary data, such as archival records, reports, and notices were also gathered as part of this study. It is possible to conclude that this study meets the criteria for reliability and validity because of how data was collected (data triangulation) and how it was designed (case study procedure).

4.8.3 Sampling of Organizations and Respondents

As stated previously, this research is a multi-case study on sustainable procurement among two big garment companies where 4 respondents were chosen with several years experience in apparel industry. The garment industry is enormous, with numerous people and organizations involved at various levels (up-stream, down-stream SC). In fact, the industry's supply chain activities are diverse, with a complicated network supply chain structure. For this research, the resources (money, time, staff, and tools) required to conduct a full analysis or evaluation of sustainable procurement in this large industry with a complicated supply chain are not accessible. To address its research issues, this report used a two-case study approach, focusing on supply chain resiliency and sustainable supply chain drivers through industry innovation. The author identified these case-study originations to discover relevant responses and explanations to the research issues.

5.0 Case Description

5.1 Case study Company 1 : Square Textiles Ltd.

5.1.1 Background

Square Textile Limited has been selected in this research paper as an ideal illustration in context of sustainability approach because “Corporate Sustainability” is interwoven in Square Textiles Ltd.'s beliefs and values, concentrating on social, environmental, and economic considerations. Circularity in manufacturing allows the company to boost profits, reduce material usage, energy consumption, and waste, and increase social responsibility.

In this research paper we will illustrate this company “Square Textile Limited” as a bench mark for other company who are not approaching Circularity: Reduce, Reuse, Recycle method in their production process. Therefore this company will be demonstrating as how or what process through which other company can implement to achieve their sustainability commitment.

5.1.2 Company Profile

Year of Establishment	2001
Commencement of Production	2002
Business & Products	Readymade Knit Apparel • Polo Shirts • T-Shirts • Tank Top • Trousers • Hooded Jacket & Cardigan • Sports Wears • Mens & Ladies Fashions Wear • Kids Wear
Total Manpower	6700 Approximately
Production capacity per day	1400 dozen of T-Shirt 1200 dozen of Polo Shirt 1400 dozen of Women & Kids Wear 1000 dozen of undergarment
Target Market	Europe and USA
Major Buyer	PUMA, MARKS & SPENCER, KITARO, PIRMA, H&M
Total Turnover Year 2020	95,260,674.56 \$US
Initial Investment	\$US 15.00 million
Factory Area	Total land area 5212 decimal (52.12 acre) Total Production area 2,81,588 sft One single storied & one three storied centrally air-conditioned modern handling system facilitated building

Table 8 : Profile of Square Textiles Limited at a glance

(Source : Square annual report, 2020)

With an emphasis on Corporate Sustainability, the company has developed an integrated approach to governance and management practices, which incorporates both financial and non-financial aspects, as well as an open platform where financial, social, and environmental issues can be discussed and communicated to all stakeholders. Positive outcomes for all parties involved in the value chain have been achieved as a result of these efforts.

5.2 Square’s mission, Slogan and Sustainability Promise

5.2.1 Mission

“To Produce Quality and Innovative Fabrics To Meet Human Aesthetic Thrust Towards Fashion Maintaining High Level Ethical Standard And Eco Friendly Production Process.

5.2.2 Slogan of Square

The rhythm of SQUARE: Square is about harmony and integration, between the elements of its own microcosm, and with the macrocosm outside. The success of Square is the vindication of its faith in human Endeavor, in the prophetic power of human aspiration.

5.2.3 Sustainability Promise

Protecting the environment from damaging by-products of activities prompted the sustainability team to initiate a variety of cost-effective and resource-saving initiatives. All initiatives must include the 3 R’s – Reduce, Reuse, and Recycle.

5.3 Supply Chain mapping of Square Textiles Ltd.

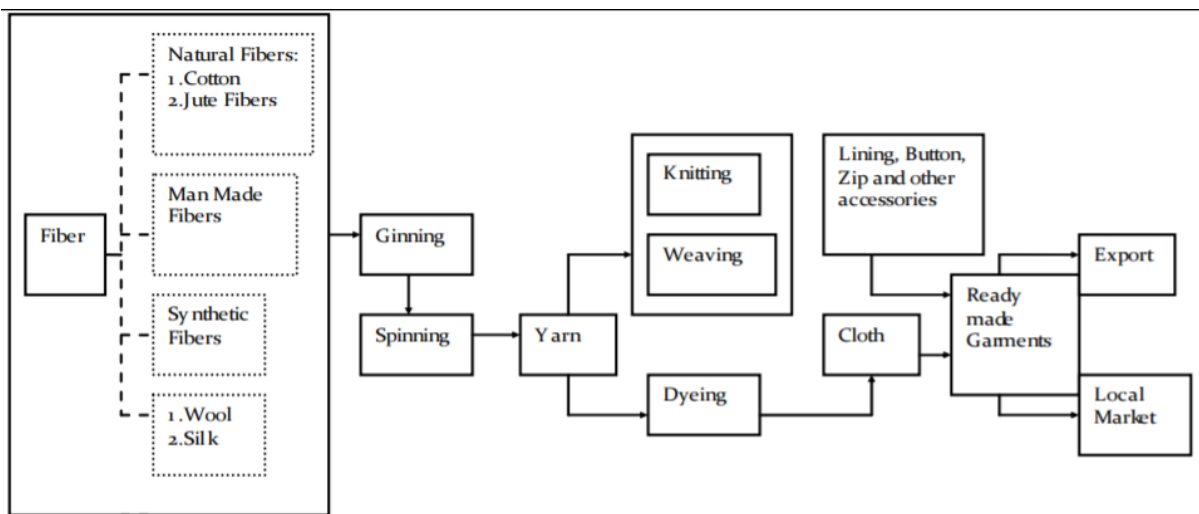


Fig .29 Supply chain of Square Textile Ltd. (Farhana,2014)

5.4 Contribution of Square on 3BL (Economic ,Social and Environmental)

SQUARE believes in sustainable development and places a high value on environmental preservation and ecological balance. The entire industry site blends in with the surrounding landscape, and the area's native ecosystem has been carefully preserved. They have a biological treatment program as well as an energy conservation program. For biological waste treatment, cutting-edge technology was used in their dye house's effluent treatment plant.

5.4.1 Economic Value Generated by Square Textile Limited

Total net sales of Square Textile Limited (garments unit), Square Fashions Limited (Fabrics Unit) and Square Knit fabrics Limited are \$US 156,694,670 in the year 2020. Here an overview of economic value generated by Square Fabrics & Garments units:

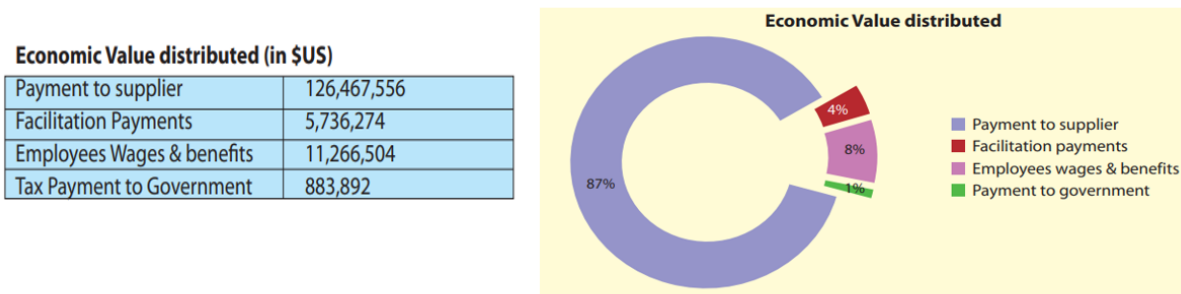


Fig 30 : Economic value of Square Textile Ltd. (Square Annual report :2020)

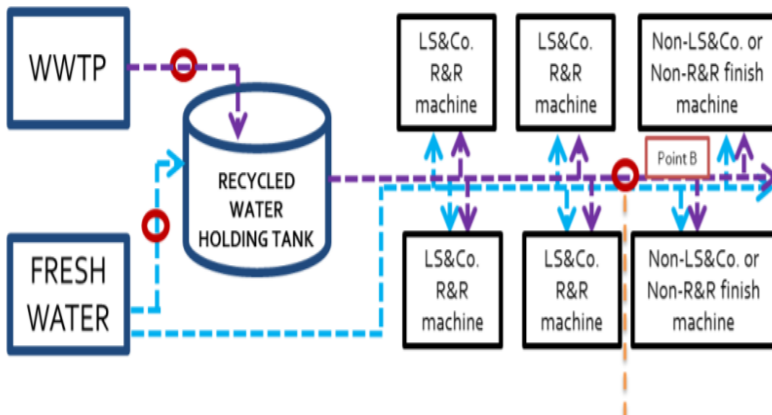
5.4.2 Environmental value generated by Square Textile Limited

Water Management : Square Apparels Ltd. is committed to the earth and the society focusing on to 3R: Reduce, Reuse and Recycle. They have percolation pits to recharge the ground water. For manufacturing, Square has state-of-the-art machinery that can recover condensate and reuse cooling water, saving both energy and water. Additionally, 118 tons of carbon dioxide equivalent (CO₂eq) are saved each year by using this method. Cool water 25 °C swaps high temperature from hot water in the heat exchanger and rises above 65 °C after draining the hot bath. A hot water reservoir collects the cooling return and steam

condensate, which is then combined with the pumped-up ground water. Water level and temperature should be kept at 45 to 50 0C in this instance. The coloring procedure uses this water.

When the Department of Environment in Bangladesh approved SQUARE's waste water treatment plant in 2009, it was one of the country's largest. Ecological preservation and sustainable development are at the top of SQUARE's priorities. It was in 2002 that SQUARE built an effluent treatment plant, with a capacity of 1200 cubic meters per day, that originated in Italy. On 2006, Square invested \$1,45,000 in a new euent treatment facility with a capacity of 3000 cubic meters per day that originated in Italy. Waste water treatment capacity now stands at 4200 cubic meters per day.

- Two meters at the beginning to quantify amount of recycled and fresh water being added to the holding/mixing tank.
- Configured to allow for blending of recycled and fresh water if desired. Blended water must include at least 20% Recycled water.
- There are two main lines: one is for recycled water, the other is for the fresh water back-up source.
- Each laundry machine has two pipe connections.



•Flow meters are required at Point B if there are Non-LS&Co. machines or Non-R&R finishes after the LS&Co. R&R machines so that the quantity of water used for these machines is not counted with LS&Co. R&R water.
 Note: A non-LS&Co. machine is used for another retail partner and a non-R&R finish machine is used for LS&Co. but does not use recycled water.

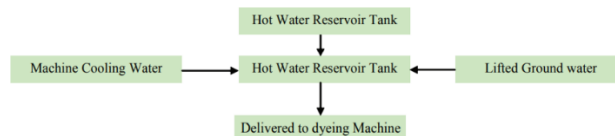
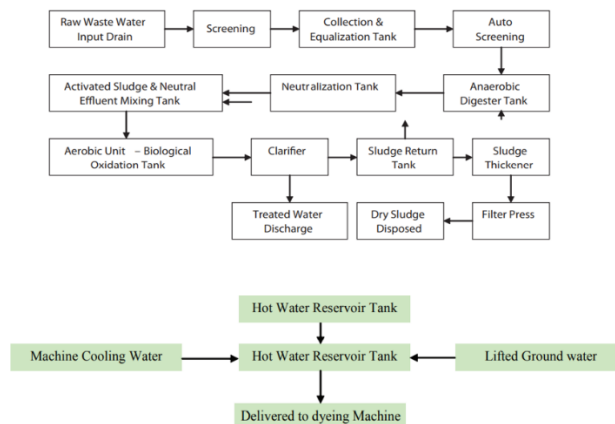


Fig 31 . Water disposal for reusing mechanism of Square Textile Ltd.(Square Annual report :2014)

Harvesting rain water : Consumption of water is a concern. Groundwater and rainwater are the primary sources of fresh water. However, rain water must be treated before it can be utilized for anything other than flushing toilets and flushing toilets. Due to these considerations, in 2010 Square built a rainwater collection plant with a capacity of roughly 9000 cubic meters of storage space More than 28 million liters of subterranean water are saved each year thanks to a 250,000-square-foot roof-top rainwater gathering system.

Reusing utility water : The water used everyday in the wash basin by employees is recycled for gardening around the main buildings. This project conserves approximately 500 liters of water daily.

Recycling organic waste : 30 tons organic compost fertilizer every month.The fertilizer is made from employee leftovers, local kitchen trash, cotton dust from the spinning mill, cow manure, water hyacinth, and other natural components.

Energy efficiency: Square Textile Ltd. is more committed to the community because of its focus on energy efficiency. When it comes to manufacturing, they only utilize the most energy-efficient machines and are always looking for new ways to improve efficiency. All of the fluorescent tube lights in the factory have been replaced by LED lights. In addition to the exhaust gas boiler, there are heat exchangers, heat recovery systems from hot waste water, and an exhaust gas chiller. As a result, 3575 tons of CO₂eq of greenhouse gas (GHG) emissions are avoided each year by saving 1,413,915 m³ of natural gas and 2295 MW of power.

Renewable energy program

A worldwide call to action to end poverty, safeguard the environment, and promote peace and prosperity for all by 2030 was issued by the United Nations in 2015 when the Sustainable Development Goals (SDGs) were accepted by all member states. Bangladesh is a UNDP SDG partner country. As a spinner, SQUARE Textiles Ltd. consumes 19.50 MWh per day. 16 and 50 megawatts of natural gas and HFO were used to generate energy in addition to the REB and other commercial power plants. A solar power project by environmentally-friendly SQUARE Textiles Ltd. has commenced its first phase. The following are the advantages it has in terms of both the environment and the bottom line.

Because of its focus on energy efficiency, Square Textile Ltd. is more community-oriented. There is a constant search for ways to improve efficiency, and they only utilize the most energy-efficient devices.

LED lights have replaced the factory's fluorescent tubes. Exhaust gas chillers and heat exchangers are also part of the system. This prevents the emission of 3575 tons of CO₂eq and saves 1,413,915 m³ of natural gas and 2295 MW of electricity each year.:

Installation Capacity	2,646 Kwh
Service period	25 Years
Energy Generating (Yearly)	4,683,420 Kwh (Daily average 6 hours-2,205 Kwh)
Carbon Emission (Yearly)	3,138,818 Kg (Equivalent 1.43 Lac Matured Tree Plantation)
Water Savings (Yearly)	43.46 Lac Liters (1 Lack equal 100000)
Energy Cost Savings (Yearly)	BDT 2.58 Crore

Table 9: Renewable energy program of Square Textiles Ltd. (<https://www.squareapparels.com/>)

5.4.3 Social Value Generated by Square Textile Limited

The total workforce of Square Fashions Limited and Square Knit Fabrics Limited are 8653 in the reporting year 2011. All of them are full time permanent employee. There is no discrimination in employment in terms of salary, benefit, advancement, discipline, termination or retirement, gender, race, religion, age, disability, sexual, orientation, nationality, political opinion or social or ethnic origin.

Health and Safety :

Health and safety issues in the workplace are increasingly becoming a major cause of concern for every organization. It is possible that insufficient control over the safety issue will result in significant injuries or even death. Consequently, Square has always prioritized safety awareness, which is understood and practiced on a daily basis by everyone who works in the plant. Prevent industrial injuries from occurring by conducting a risk assessment before they occur. The purpose is to ensure that potentially dangerous work procedures are carried out and machines are run as safely and efficiently a feasible. The following process will be used to ensure that health and safety issues are addressed in our organization.

Occupational Health & Safety management system : The hazard identification is the process of recognizing that a hazard exists and dening its characteristics with regards to workers environment and its activity.

Training and Development

Training name	Hour
Risk Assessment	1838
Chemical Handling	3672
Fire fighting & Equipment	6286
Vaccination	2700
Worker Rights & Responsibilities	5978
Standard Operating Procedure	1348
HIV, Family Planning and Sanitation	5865
First Aid for all worker	5998
Product quality & Development	6286
Environmental Policy (ISO 14001:2004)	1285
Standard Operating Procedure (ISO 14001: 2004)	1348
First aid and use of PPE	1845
Environment Health & Safety	1345
Dyes and Chemical Handling	1782
Product quality and development	1830
Training hour per employee for approximately 7236 in Square Textile limited 09 (nine) hours.	

Table 10: Training and Development program of square (Source :Square Annual report 2019)

5.5 Products of Square Textiles Ltd.



Fig 32: Products illustration of square textile Ltd. (Source : <https://www.squareapparels.com/>)

5.6 Certifications

The certification programs for clothing and textiles assist firms in the garment sector in putting their products through stringent standards in order to assure compliance with appropriate product requirements.

Following is a benchmark that Square Textile Ltd. has attained in their products:









Name	Symbol	What does the label mean?
Oeko-Tex® Standard 100		Every fiber, button, and other fashion accessory has been thoroughly tested for hazardous compounds, and as a result, is completely safe for human consumption. Source : (WANG,2009)
SUPIMA Certificate		Supima cotton is a top-notch type of cotton that is created from <u>Gossypium barbadense</u> . It is one of the smoothest and comfortable forms of cotton in the world. Source : (Oncul,2021)
National Environment Certificate		Miljøfyrtårn is the most extensively used certificate in Norway, and it is used by businesses who want to prove their environmental efforts and demonstrate social responsibility. Source (Karlsson,2021)
Member of BCI (Better cotton initiatives)		Opportunities arise as a result of improved soil and water management, less pesticide use, and increased climate change resilience. Smallholders will benefit from a better crop and greater market access. Farm workers and farming communities will benefit from better wages, greater gender equality, and a reduction in social disparity.. Source (Makhdum,2011)
ISO 9001:2008 Certified		In order to demonstrate its capacity to consistently meet customer and applicable legislative and regulatory criteria, a business must have a quality management system in place..Source : (Adem,2020)
FAIRTRADE Certified		Fairtrade certification is a product certification system that certifies social, economic, and environmental elements of production..(Ruggeri,2021)
ISO 14001:2004 Certified		To design and implement policies and objectives that take into consideration legal and other requirements, as well as information regarding key environmental elements, ISO 14001:2004 sets requirements for an environmental management system. 2012)
Certified by Cotton USA		Cotton USA promotes American cotton fiber and cotton-based goods around the world. It is essential to find a responsible agricultural production system balance between economic growth, environmental protection, and social responsibility in a sustainable farming system. (HaBrookshire,2011)

Table 10 : Sustainable certifications achieved by square textiles Limited.

Source : (<https://www.squareapparels.com/>)

5.7 Case study Company 2 : Snowtex Apparels Limited

5.7.1 Background:

Snowtex apparels Limited has been selected in this paper as an illustration to compare with the Square Textiles Limited. In this research paper we will compare with “Square Textile Limited”, a 3R (Reduce, reuse, recycle) application company to see how Snowtex apparels Limited can make an impact to the 3BL aspects of sustainability context.

Company Background

A mid-sized apparel manufacturing company in Bangladesh, Snowtex Outwear Ltd is a subsidiary of the Snowtex Group. Snowtex Group is a diverse and integrated manufacturing firm situated in Dhaka, Bangladesh, with a significant backward connection. The facility, which began operations in 2005, presently offers capabilities for quilting, cutting, printing, sewing, and finishing, among other things. Snowtex is one of the largest and most export-oriented woven garment manufacturing industries in Bangladesh, with a 100% focus on exports. They are a global supplier of high-quality garments, serving the greatest stores and the most recognizable names in the fashion industry all over the world. Snowtex currently employs more than 17000 people and has an annual turnover of \$250 million dollars. Starting from the day of its establishment, Snowtex has grown steadily and continuously to become one of the most capable and professionally well-equipped organizations in the RMG sector of Bangladesh. In a very short period of time, the company has amassed a substantial body of knowledge and experience in the fields of sourcing and manufacturing high-quality garments. The company can take great pride in having completed the most challenging and demanding orders from diverse regions of the world with precision and to the complete satisfaction of its renowned customers of high reputation and standard.

5.7.2 Companies Mission, Vision and Sustainability

Mission : To continuously improve company’s performance by learning & implementing new system, method & technology.

Vision : Snowtex will be a leading organization in the country by honoring its commitments and obligations to its partners (customers and suppliers), making the company a great place to work, and selling high-quality garments to the greatest stores and fashion brands throughout the world.

Sustainability : Snowtex Group has been covered by renowned apparel magazine Goble for focusing on sustainability aspect on manufacturing. They achieved 20% waste reduction in their innovative water disposal system. In the assembly line it has semi-automated and low noise pollution system, low power consumption machine which is monitored by highly advanced inter-control several drive technology.

5.7.3 Certification : Snowtex has already achieved a cluster of Awards & Certifications during its more than a decade’s journey. It has achieved all necessary certification to continue the sustainable production processes. Such as: “ISO 14001: 2004 for Environmental rules & regulations” “Oeko Tex Standards” ,Factory of year award by Alpha Broader,Accreditation of Lab by renown brand- Puma, M&S. Snowtex apparels Ltd. has achieved Gold certificate compliance and Factory of the year 2011 and 2012 consecutively.

5.7.4 Production

Snowtex outwear Limited are producing only Knit items (T-shirts, Polo Shirts, Sweat Jacket, Trouser) for Men’s, Ladies, and Kids. Total production is 750,000 pcs per month. This includes all types of items (T-shirts, Polo Shirts, Sweat Jacket, Trouser)

Table 11 List of Products and capacity as of 2020 ,Snowtex Apparels Ltd.

Name of Product	Production Capacity per year
Work wear	240000
Safety wear	180000
Fashion wear	650000
Sports wear	345000
Bottom wear	350000



Fig 33 :Products sample of Snowtex Apparels Ltd. (Snowtex ,2021)

5.7.5 Supplier of the Company

Snowtex has a joint venture investment with a US based workwear company Berne Apparel, which is a great example of supplier as a strategic partner. Apart from the local supplier are C.S Knit, Azad Rifat Fibers, Sarker design and printing, ANZ accessories.

Products are Supplying by the Supplier: Fabrics, Fabrics Printing solution and nominated accessories

5.7.6 Customer of the company

Berne, Canada Sports wear, Colombia, Gloria Jeans, Kaufland, Debenhams

5.7.7 Supply chain of Snowtex apparels Ltd.

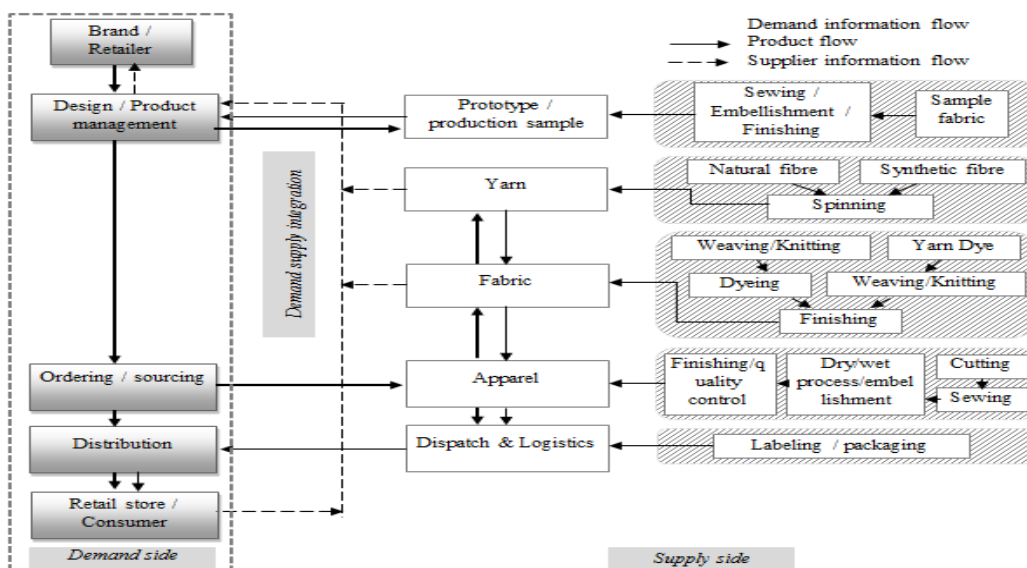


Fig. 34 :Supply chain of Snowtex apparels Limited (Snowtex,..2017)

6.0 Chapter 6 :Analysis and Discussion

6.0 Analysis and discussion of Research Questions

In this chapter, the author will use the findings in the previous chapter combined with the theoretical background from chapter 3 to answer the given research questions. All this to solve the research problem of this thesis, “The author will answer the RQ’s chronological, which makes the most sense since the first research question concerns SC resilience contribute to social and environmental sustainability efforts during and Post Covid 19 Pandemic

6.1 Analysis and discussion of Research Question 1

RQ 1 :How can supply chain resilience contribute to social and environmental sustainability efforts during and Post Covid 19 Pandemic?

According to the definition, resilience is the ability of an organization or system to survive and adjust in the change and uncertainty while still growing and developing. The components that contribute to SC resilience are highly interconnected and are influenced by the dynamic spectrum of infrastructure available. When it comes to reducing SC risk and increasing SC resilience, procurement and SC management must pay greater attention to infrastructure investment during the post-pandemic stage. Because the supply chain for ready-made garments is lengthy and interdependent, in order to dig deeper into the question, the author has identified ten possible impacts of the COVID-19 outbreak that can trigger SC vulnerability that have been proposed by the informants (Table 7)

Table 12 : 10 Supply chain vulnerability in RMG industry in covid 19 Outbreak

Impact Code	Impact Name	Description	Proposed by interviewee
IM1	Orders deferred from vendors	unable to reach customers due to lack of different choice	M1
IM2	Reduced production	Decreased production lead to unfulfilled orders	M3
IM3	Slow shipments	Due to a lockdown, there is less shipping capacity and higher delivery charges	M3
IM4	Delayed production	Slow operational flow due to social distancing	M2
IM5	Unavailability of the operator due to sickness	Difficult to get a replacement employee	M2
IM6	Shortage of operation, maintenance, and surveillance(OMS)	Enhanced operation cost and decreased productivity.	M3

IM7	Change of delivery and order cycle	delivery time may be rescheduled as well as affect the order cycle which can create demand and supply disruption	M1
IM8	Unforeseen Inventory	Excess inventory due to order cancellation	M1
IM9	Increased level of job cuts	Due to reduced production and operation	BH1
IM10	Impact on global trade	Slow credit flow from banks and Foreign direct investment (FDI)	M2

Based on the discussions and remarks from the four responders from these two case companies (Table 7), 22 possible managerial methods have been evaluated for further investigation and are included in the next section. The responses are gathered from each member individually either personal interviews or telephonic interviews, depending on their geographical location at the time of the interview. A list of potential options for dealing with the consequences of the COVID-19 outbreak in the RMG supply chain is described in Table 13 of this report.

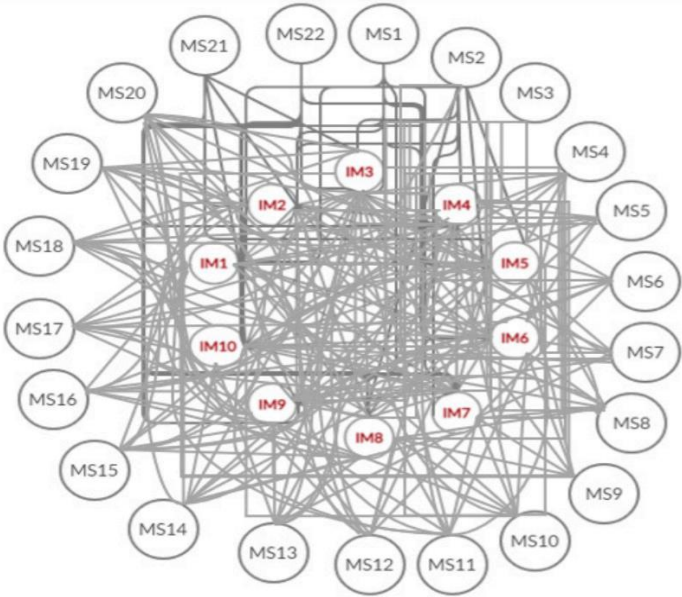


Fig 35 Digraph to represent the influences of mitigation strategies

Strategy Code	Strategies	Descriptions
MS 1	Pricing flexibility	Price reduction by offering a rebate or discount

MS 2	Looking for alternative buyers	Reducing the risk of canceled orders
MS 3	Expand the source of supply chain and develop backup suppliers	Diversifying sourcing activities among multiple suppliers protects a company from the effects of supply chain disruption.
MS 4	Government enticements	Government incentives (Corporate Tax exemption, subsidy) are required for the organizations when corporation is meeting their stranded
MS 5	AI and big data-based supply chain transparency	Integrate all supply chain data to avert potential interruptions
MS 6	Facilitation of e-commerce	Applications are launched and a tracking mechanism is deployed
MS 7	Production flexibility	Changeover of operating instructions and set up of the assembly line
MS 8	Using Big data to predict time series analysis	Using innovative analytics to capitalize how supply chain changes the operating.
MS 9	Maintaining buffer inventory	Reduce the effect of factory shutdown keeping buffer inventory
MS 10	Introducing a comprehensive system	Decreases capacity risks
MS 11	Health and safety training	Train the workforce on virus transmission , precaution, and vaccination
MS 12	Train backup operators	Make backup operators proactively available
MS 13	Adopt social and behavioral change resources	Using PPE, ensuring social distance, hand sanitizer in the factory.
MS 14	Flexible work shift or overtime	Rotate working hour to prevent transmission of virus
MS 15	A campaign of “social distancing” measures such as isolation, work from home as many staff possible	Enhanced proactive measure to spread the virus
MS16	Make backup operators readily available	Basic Operation ,Maintenance and surveillance (OMS) Training of staffs
MS 17	Supply chain Redesign	Adjusting approaches for COVID19 outbreak
MS 18	Improve agility in supply chain network	Prioritizing cost over responsiveness for slow-moving product and vice versa for fastmoving products
MS 19	Flexible payment method	
MS 20	offering products at lower price to control inventory	

MS 21	Increase contractual workers	Decreases the risk for lay off permanent workers
MS 22	International policy for effective control over health and safety guidelines	Multi-layered international and Intra- and interorganizational coordination to reduce the virus infection .

Table 13 : Possible strategies to make resilience SC in post pandemic

According to the approach, mitigation methods are ranked based on the significance of the link between SC risks as well as the positive and negative influence of the mitigation measures on the consequences of the risks. Digraphs are used to highlight the importance relationship between the affects of COVID-19 on SC and the positive and negative influences of mitigation measures on the impacts, as illustrated in Figures 35 .

6.2 Research Question 2 :How can digitalization and innovation contribute to improving sustainability of RMG industry in Bangladesh?

How can technology and digitalization in the SC can improve the information flow in relation to contribute towards sustainability in the RMG industry? This exact question were used to identify what needs to be improved in digitalizing of the current RMG supply chain. While digging deep with discussion with four respondents from the two following case company (Table 7) the key findings are:

- *Because of a lack of digitalization, information is not being transferred to a large extent. -M2*
- *Suppliers are experiencing difficulties due to opportunistic behavior. -BH1*
- *Inadequate use of digital procurement authenticity-M1*
- *Lack of tracking or registration of materials -M1*
- *Because of the need for trustworthiness and confidentiality, SC are not interconnected. -M3*
- *Lack of certification and awareness of end customer about certification in apparel industry. -M1*
- *There is no transparency when it comes to the materials utilized in the fibers of garments..-M2*

Integrating blockchain technology with existing systems Because enterprise resource planning (ERP) is critical in all supply chains, the experts were asked how difficult it is to integrate blockchain with ERP.

BH1 *“Using blockchain technology, it is feasible to digitally access all records and records within the network, as well as maintain track of each department's information and product information. It will increase system efficiency by reducing waste, saving money, and preventing illegal activities like unethical sourcing and child labor.”*

M1: *“Blockchain is not integrated by current ERP systems. The big manufacturers have to adapt to the new technology of blockchain..”*

M2: *“We provide an ERP-plugin. This plugin establishes a connection to business processes. That may be a invoice. Rather than sending it via email, the invoice will be sent to the blockchain, and from there, it will be sent to the recipient. It is simple to migrate to a blockchain-based ERP system.”*

Specifically, this section of the thesis contains a discussion of the majority of the past literature that has been conducted in trying to answer the topic. Technological advancements in our daily lives are becoming increasingly faster, more portable, and higher-powered than they have ever been. With all of these breakthroughs, technology has also improved the quality of our lives by making them easier, faster, and more convenient. Following a consideration of the literature, it has been established that the SC of the apparel sector is lengthy, and that there is a gap in information sharing within the SC about raw materials selection, ethical sourcing, certification standards, and so on. This is established in the literature. Blockchain technology can be used in supply chain management to provide solutions for data monitoring, contracts, and resource sharing among participants. As a result of these applications, supply chain partners can avoid the risks and costs associated with opportunistic behavior in partnership by transitioning trust away from relational trust and toward system- and cognition-based trust. Certifications, according to earlier literature, can assist in enforcing the sustainable paradigm; nevertheless, the inability to transfer data in order to integrate the entire SC blockchain may be the future of data transfer technology. Interviewees M2 and M1 agreed that it is high time to connect technology in order to integrate the supply chain in order to reach a sustainable paradigm as a result of their discussion about this particular subject. by compiling all of the conversation into a suggestion on how blockchain could improve the flow of information regarding materials When developing a proposal of this nature, a variety of ways could be used. Nonetheless, the author has chosen a straightforward representation to demonstrate how blockchain might connect the many stages and participants in the value chain by functioning as a data layer between the various links in the chain.

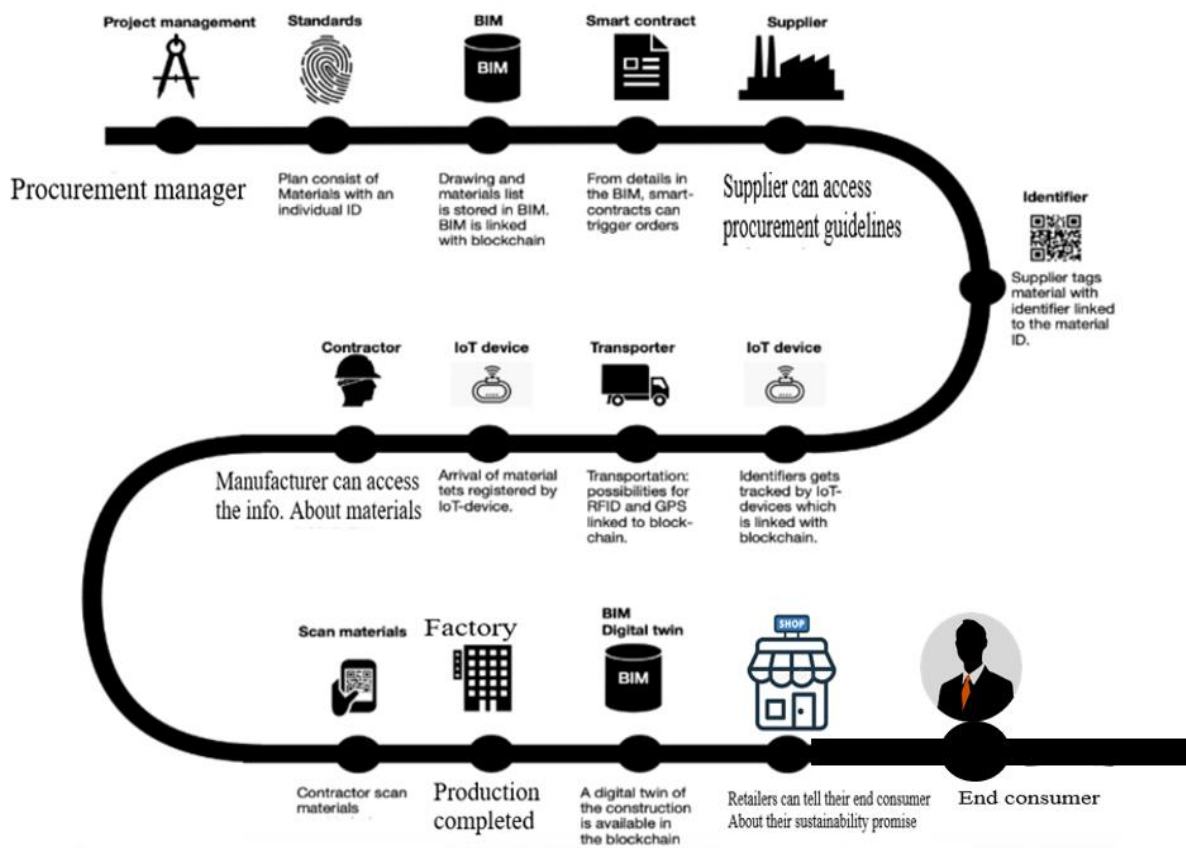


Fig 36 : Projected resolution for blockchain integration (Source :Own Elaboration)

However, it is very important to mention that it does not take into consideration the complications associated with deploying blockchain. It is also more straightforward and only intended to provide a general impression of how it might be (Fig. 36).

6.3 Research Question 3 : What are the driving factors that can facilitate to achieve sustainability in the context of the Ready-made Garments industry?

In order to fully grasp the concept of sustainable development, an integrated approach to economic, environmental, and social development must be taken into consideration.

When developing a sustainable strategy, culture, leadership, and corporate social ideals are critical factors. In order for sustainability to succeed, all stakeholders of the social concept (customers, suppliers, employees, investors, and the local community) must be involved in the process of continuous innovation, which includes the implementation of effective stakeholder engagement policies and strategies that at the same time lead to the formulation of creative alternative ideas and solutions for existing production systems.

M1 pointed out the fact that "Sustainability has a price and the end customer need to be aware why they are paying for?"

He also emphasized *“When it comes to sustainability, development must be centered on people, and the approach to sustainable design must begin with the business model when it comes to prioritizing sustainability.”*

When it comes to developing environmentally responsible business strategies, fashion companies are aiming for a proactive and comprehensive approach that incorporates all functional areas. As a result of the development of proactive green strategies, this organizational capability is positively associated with the improvement of territorial infrastructure and the requirement to establish a network of strong local relationships in order to create value through the achievement of a shared goal, such as the development of a socially responsible environment (Fig 37). When it comes to the fashion industry, sustainability is also a critical strategy for improving a company's reputation with consumers.

M3 : *“It is an essential component of the competitive success value proposition. Organizational and cultural change are required for an eco-friendly approach. This action must begin with leadership and then spread to the entire organization, then the entire industry, and so on....”*

Aside from the " environmental impact," sustainable design must also produce meaningful innovations that can balance the economy with society, in order to foster long-term relationships between the object or service and its users.

1. Sustainable Product design
2. Process design that can integrate the Supply chain
3. Value Network design
4. Relational design
5. Design of ‘circular’ consumption pattern.

As a result of a shift in management style and behavior, many fashion start-ups have the potential to change the fashion sector into a long-term, sustainable business model. There are a number of external elements that influence the creation of green strategies, such as the increasing attention of customers to environmental issues and the dynamic nature of the market.

M2 underlined *“The demand for products made by ethical companies that do not exploit labor or pollute the environment is growing. The coincidence of entrepreneurial orientation and customer sensitivity to environmental issues promotes an action orientation toward social legitimacy, which can strengthen and*

differentiate the company's position through the positive influence of an apparel brand's goodwill reputation..”

Finally incorporating sustainability into brand promise M1 closed his remarks *“Every consumer has power of his own purchase and Every time a consumer swipes his credit card,he can make a statement of his voting for sustainability which can make a difference for a big picture.....”*

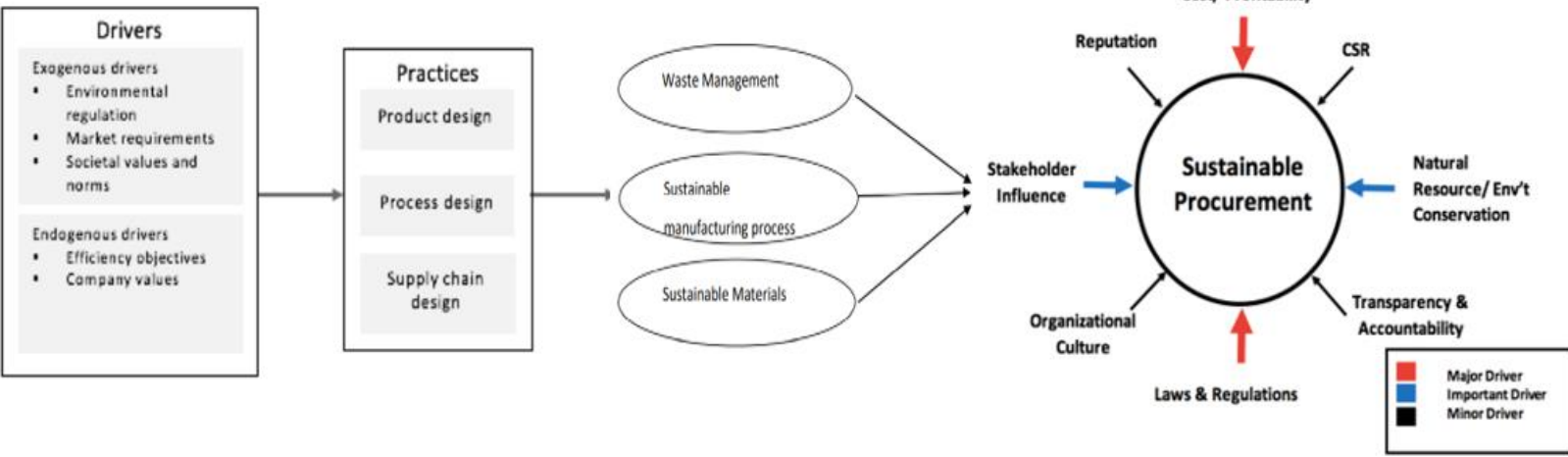
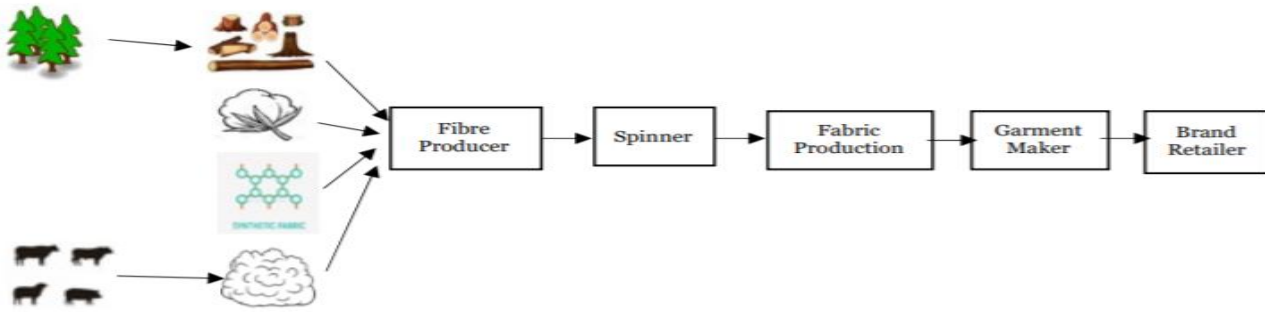


Fig 37. Drivers of sustainable procurement (Source: Own Elaboration)

6.4 Practical and theoretical implications

This paper represents a comprehensive understanding of the literature on resilience components of supply chain management (SCM) in the fashion sector, with particular emphasis on the relationship between capabilities and vulnerabilities. One of the most important factors in the transition from traditional to circular businesses was the use of a resilient approach. It was discovered through the research that there are several capability components that can be used to close the expertise gap as well as give the core knowledge needed to better deal with the rising problems. Management must place a high focus on resilience as well as learning from current occurrences in order to make better judgments moving forward if the garment business is to thrive. This study also highlights the importance of effectively coordinating capabilities and weaknesses in SCM in order to improve competitiveness and efficiency.

Regarding theoretical implications, this research makes an important contribution to the field of resilience management in supply chains by focusing on supply chain resilience. This lesson gained from the COVID-19 context, specifically from the RMG industry in Bangladesh, provides valuable insights into how capabilities management in the face of vulnerabilities can have a direct impact on the performance of the supply chain in the long run. Despite the fact that this study has some limitations in terms of generalization, it identifies important drivers for future empirical and broader studies, and it serves as the foundation for future quantitative studies on the aspects of capabilities and vulnerabilities that affect supply chain resilience.

Traceability of supply chains has become a major concern for a wide variety of companies, regulators, and policy makers. End customers are increasingly demanding assurances about the origin and sustainability of the products they purchase. The textile and garment sectors, particularly fiber producers, are significant globally and can considerably benefit from the usage of blockchain technology. Despite fiber producers' best efforts to ensure that their sourcing and manufacturing processes are environmentally benign. However, social, environmental, and sustainability concerns are prevalent in this area. While blockchain technology has shown promise in terms of increasing transparency, enabling traceability, and promoting sustainability in the textile and clothing supply chain, the technology is still in its early stage of adoption.

7.0 Conclusion

7.1 Chapter Introduction

This chapter brings out the closing remarks that conclude the study by discussing the research summary, managerial implications, limitations of the study, and suggestions for further research.

7.2 Research Summary

The purpose of this study was to create insight and knowledge about the factors that are preventing or facilitating the transition from linear to circular economies in the textile and apparel sector in Bangladesh by identifying current and desired interactions among the ecosystem's stakeholders that are triggering long-term viability. The researcher's central theory, which said that "a weak linear ecosystem applied to the textile and apparel sector in Bangladesh is dictated by inadequate relations among the stakeholder" was found to be correct. The following are the barriers to making the circular economy "work in practice" that have been identified as a result of this research: The existence of a vicious circle (Gharajedaghi, 2011) of various actions leading to the consolidation of the mechanisms that feed isolation and prevent a shift from "silo mentality" to collaboration; and the absence of collaborative spaces in which members of the textile industry can come together to network, connect, and explore the various opportunities to collaborate through certification. The absence of the perceived sensation of "we are all in the same boat," which is naturally promoted by teamwork, leads to the perpetuation of the vicious circle of inaction. Due to a lack of digitalization in the garment supply chain, there is a general lack of awareness about "circular economy and textile and apparel" and its mechanics. In Bangladesh Ready made garments sector has substantial economic contribution by being the 2nd largest exporter, it is high time to focus on environment over employment to make this industry viable in a long run by adopting technology in the supply chain networks.

This year's COVID-19 pandemic has had a significant influence on the global supply chain as well as demand for the whole fashion industry. As a result of raw material sourcing challenges and canceled orders, top exporters such as Bangladesh have begun to feel the heat. When it comes to a developing south Asian economy like Bangladesh, the performance of the supply chain resilience for the RMG industry is becoming increasingly important. It is essential to evaluate the demand side situation by segmenting the garment export markets into three categories: Europe, the United States, and developing markets. The idea of strength encompasses a larger range of activities than simply coordinating SCM,

coherence planning, risk administration, or a combination of all of these disciplines in order to accomplish the sustainability objectives of an apparel brand.

The key findings suggest that mapping a digital and networked SC, which may integrate the SC stakeholders to apply sustainable paradigms, is an appropriate method for achieving this goal. Because of the steadily rising costs of energy, business contamination, a scarcity of vital raw materials and natural resources, and environmental blunders, sustainability has risen to the top of the list of future concerns.

7.3 Managerial Implications

Based on a thorough examination of this thesis, we can conclude that digitalization in SC, such as blockchain technology, can assist procurement managers in meeting their sustainability brand promise. Though it is still in its initial phases, a wide range of applications show that it has the possibility to become a driving force in achieving sustainability paradigms. Because the manufacturer requires a high level of trust for strategic partnerships among various SC parties, which blockchain technology can provide.

Blockchain offers numerous opportunities to the various supply chain partners involved in the textile and apparel sectors, particularly fiber producers. Regardless of the efforts made by fiber producers to ensure the sustainability of their sourcing and production activities, their efforts may not be fully recognized by brand retailers or end-consumers. Furthermore, there is no guarantee that what reaches the end-user was made from an authentic and sustainably produced fiber. Fiber producers can securely identify and track the use of their fibers at each stage of the downstream supply chain using blockchain and appropriate product identification techniques, ensuring the authenticity and sustainability of their fibers, and gaining a competitive advantage over competitors. They may also be able to improve their operational performance by increasing visibility, information sharing, and transparency throughout the supply chain.

7.4 Limitations of the study

A research project involves various challenges that the researcher may encounter throughout the process, and it is important to recognize these challenges. This does not invalidate the study, but it does present some difficulties during the design process and in terms of the quality of the data employed. During the course of this research, the following constraints were discovered:

The textile industry is now experiencing a dearth of research into blockchain technology. However, by merging all of the preceding research, the author was able to establish a sufficient theoretical framework. Fieldwork has become more difficult as a result of the epidemic, and traveling around visiting companies

should be avoided during this time. As a result, the author is unable to gain first-hand knowledge of how various operations are carried out.

The time window for completing a master's thesis is also extremely constrained. The SC resiliency that is causing the disruption in the garment supply chain is extremely dynamic, and the same can be said about blockchain technology. More time spent working in the textile sector is required in order to properly comprehend both of these concepts.

From the perspective of view of research individuals are frequently obligated to give a positive vibe of their own organization's policy and structure when asked their opinions on sustainable procurement because of the social desirability bias, which occurs when respondents feel they are acting in a socially acceptable manner with regard to sustainability when asked their opinions on procurement.

7.5 Suggestion for future Research

Because blockchain technology has not been widely adopted yet, there has been little discussion of empirical situations in the literature on blockchain applications in the supply chain to date. The difficulties raised by the case study covered here are pertinent to the adoption of blockchain technology in the textile and clothing sector in general, but they are also relevant to other commodities and consumer products that have a large number of parties involved in the supply chain. It is necessary to do additional empirical research into blockchain adoption across a wide range of industries in order to understand how the technology may be used more widely to enable and support traceability in future.

References

- Amutha, K., 2017. Environmental impacts of denim. In *Sustainability in denim* (pp. 27-48). Woodhead Publishing.
- Anwar, S., Nasrullah, M. and Hosen, M.J., 2020. COVID-19 and Bangladesh: challenges and how to address them. *Frontiers in public health*, 8, p.154.
- Ahamed, F., 2013. Background of History of Bangladesh and Ready-made Garment Industry: Key challenges in the RMG Industry. *Middle East Journal of Business*, 8(1).
- Arnold, D. and Pickles, J., 2011. Global work, surplus labor, and the precarious economies of the border. *Antipode*, 43(5), pp.1598-1624.
- Ahsan, R. and Iqbal, K., 2021. The Resilience of Global Value Chains During the Pandemic: Evidence from Bangladesh. *Available at SSRN 3765097*.
- Analysis from Bangladesh-Vietnam Point of View. *Open Journal of Business and Management*, 9(5), pp.2183-2196.
- Aziz, M.T., Shahriar, S., Faiyaz, F.F., Islam, A. and Rashid 2017, A.H., Lean Logistics Strategy for the Ready-Made Garments (RMG) Industry of Bangladesh: Review and a Proposed Enhanced Strategy.
- Ahmad, S., 1990. Foreign capital inflow and economic growth: A two gap model for the Bangladesh economy. *The Bangladesh development studies*, pp.55-79.
- Ahamed, F., 2013. Background of History of Bangladesh and Ready-made Garment Industry: Key challenges in the RMG Industry. *Middle East Journal of Business*, 8(1).
- Ahlquist, J.S. and Mosley, L., 2021. Firm participation in voluntary regulatory initiatives: The Accord, Alliance, and US garment importers from Bangladesh. *The Review of International Organizations*, 16(2), pp.317-343.
- Ahmed, A., 2021. From Impoverished Beneficiaries to Empowered Stakeholders—a case study of H&M Foundation Multi-Sectoral Sustainable Initiative for female Bangladeshi RMG workers.
- Aldaya, M.M., Chapagain, A.K., Hoekstra, A.Y. and Mekonnen, M.M., 2012. *The water footprint assessment manual: Setting the global standard*. Routledge.
- Ahamed, F., 2013. Background of History of Bangladesh and Ready-made Garment Industry: Key challenges in the RMG Industry. *Middle East Journal of Business*, 8(1).

- Azadeh, A., Atrchin, N., Salehi, V. and Shojaei, H., 2014. Modelling and improvement of supply chain with imprecise transportation delays and resilience factors. *International Journal of Logistics Research and Applications*, 17(4), pp.269-282.
- Apuzzo, M. and Kirkpatrick, D.D., 2020. Covid-19 changed how the world does science, together. *New York Times*, 1.
- Akram, U., Fülöp, M.T., Tiron-Tudor, A., Topor, D.I. and Căpușneanu, S., 2021. Impact of digitalization on customers' well-being in the pandemic period: Challenges and opportunities for the retail industry. *International Journal of Environmental Research and Public Health*, 18(14), p.7533.
- Ahmed, W.A. and MacCarthy, B.L., 2021. Blockchain-Enabled Supply Chain Traceability in the Textile and Apparel Supply Chain: A Case Study of the Fiber Producer, Lenzing. *Sustainability*, 13(19), p.10496.
- Adem, M.K. and Viridi, S.S., 2020. The effect of TQM practices on operational performance: an empirical analysis of ISO 9001: 2008 certified manufacturing organizations in Ethiopia. *The TQM Journal*.
- Baily, P., Farmer, D., Crocker, B., Jessop, D. and Jones, D., 2008. *Procurement principles and management*. Pearson Education.
- Bucci, D., 2021. The use of blockchain technology in the fashion industry and its impact on sustainability.
- Bag, S., Dhamija, P., Gupta, S. and Sivarajah, U., 2020. Examining the role of procurement 4.0 towards remanufacturing operations and circular economy. *Production Planning & Control*, pp.1-16.
- Breuer, A., Janetschek, H. and Malerba, D., 2019. Translating sustainable development goal (SDG) interdependencies into policy advice. *Sustainability*, 11(7), p.2092.
- Boyer, R.H., 2015. Grassroots innovation for urban sustainability: comparing the diffusion pathways of three ecovillage projects. *Environment and Planning A*, 47(2), pp.320-337.
- Butt, A.S., 2021. Strategies to mitigate the impact of COVID-19 on supply chain disruptions: a multiple case analysis of buyers and distributors. *The International Journal of Logistics Management*.
- Boumans, T., 2021. *Garment Workers' Ability to Benefit from Digitalization of the Fashion Value Chain Exploring how digitalization of the fashion value chain affects garment workers in the global south* (Master's thesis).
- Bullón Pérez, J.J., Queiruga-Dios, A., Gayoso Martínez, V. and Martín del Rey, Á., 2020. Traceability of ready-to-wear clothing through blockchain technology. *Sustainability*, 12(18), p.7491.
- Buheji, M. and Ahmed, D., 2020. Foresight of Coronavirus (COVID-19) opportunities for a better world. *American Journal of Economics*, 10(2), pp.97-108.
- Browne, M., Rizet, C., Anderson, S., Allen, J. and Keita, B., 2005. Life cycle assessment in the supply chain: a review and case study. *Transport Reviews*, 25(6), pp.761-782.
- Begum, S. and Shamsuddin, A.F., 1998. Exports and economic growth in Bangladesh. *The Journal of Development Studies*, 35(1), pp.89-114

- Baral, M.M., Singh, R.K. and Kazançoğlu, Y., 2021. Analysis of factors impacting survivability of sustainable supply chain during COVID-19 pandemic: an empirical study in the context of SMEs. *The International Journal of Logistics Management*.
- Butt, A.S., 2021. Strategies to mitigate the impact of COVID-19 on supply chain disruptions: a multiple case analysis of buyers and distributors. *The International Journal of Logistics Management*.
- Bienhaus, F. and Haddud, A., 2018. Procurement 4.0: factors influencing the digitisation of procurement and supply chains. *Business Process Management Journal*.
- Balci, O., 2003, December. Verification, validation, and certification of modeling and simulation applications. In *Winter Simulation Conference* (Vol. 1, pp. 150-158).
- Byrne, M., Valentine, W. and Carter, S., 2004. The value of certification—a research journey. *Aorn Journal*, 79(4), pp.825-835.
- Balogun, T.G. and Andaila, A.M., 2012, May. Development and Implementation of a Health Safety And Environmental Management System In The Qatar Petroleum Drilling Department. In *SPE International Production and Operations Conference & Exhibition*. OnePetro.
- Claudio, L., 2007. Waste couture: Environmental impact of the clothing industry.
- Crewe, L., 2004. Unravelling fashion's commodity chains. In *Geographies of commodity chains* (pp. 207-226). Routledge.
- Chowdhury, S.F., 2020. *Impact of the Accord and Alliance on labor productivity of the Bangladesh RMG industry* (Doctoral dissertation, Brac University).
- Chapagain, A.K., Hoekstra, A.Y., Savenije, H.H. and Gautam, R., 2006. The water footprint of cotton consumption: An assessment of the impact of worldwide consumption of cotton products on the water resources in the cotton producing countries. *Ecological economics*, 60(1), pp.186-203.
- Chico, D., Aldaya, M.M. and Garrido, A., 2013. A water footprint assessment of a pair of jeans: the influence of agricultural policies on the sustainability of consumer products. *Journal of Cleaner Production*, 57, pp.238-248.
- Chakraborty, S. and Biswas, M.C., 2020. Impact of COVID-19 on the textile, apparel and fashion manufacturing industry supply chain: case study on a ready-made garment manufacturing industry. *Journal of Supply Chain Management, Logistics and Procurement*, 3(2), pp.181-199.
- Chunsheng, L., Wong, C.W., Yang, C.C., Shang, K.C. and Lirn, T.C., 2019. Value of supply chain resilience: roles of culture, flexibility, and integration. *International Journal of Physical Distribution & Logistics Management*.
- Carvalho, H., Cruz-Machado, V. and Tavares, J.G., 2021. A mapping framework for assessing supply chain resilience. *International Journal of Logistics Systems and Management*, 12(3), pp.354-373.

- Cheshmehzangi, A., 2021. From transitions to transformation: a brief review of the potential Impacts of COVID-19 on boosting digitization, digitalization, and systems thinking in the built environment. *Journal of Building Construction and Planning Research*, 9(01), p.26.
- D’Orazio, P., 2021. Towards a post-pandemic policy framework to manage climate-related financial risks and resilience. *Climate Policy*, pp.1-15.
- De Medeiros, J.F., Ribeiro, J.L.D. and Cortimiglia, M.N., 2014. Success factors for environmentally sustainable product innovation: a systematic literature review. *Journal of Cleaner Production*, 65, pp.76-86.
- Dejonckheere, J., Disney, S.M., Lambrecht, M.R. and Towill, D.R., 2004. The impact of information enrichment on the bullwhip effect in supply chains: A control engineering perspective. *European journal of operational research*, 153(3), pp.727-750.
- Denning, Dorothy E., and Peter J. Denning. "Certification of programs for secure information flow." *Communications of the ACM* 20, no. 7 (1977): 504-513
- de Boissieu, E., Kondrateva, G., Baudier, P. and Ammi, C., 2021. The use of blockchain in the luxury industry: supply chains and the traceability of goods. *Journal of Enterprise Information Management*.
- Debata, B., Patnaik, P. and Mishra, A., 2020. COVID-19 pandemic! It's impact on people, economy, and environment. *Journal of Public Affairs*, 20(4), p.e2372.
- de Vet, J.M., Nigohosyan, D., Ferrer, J.N., Gross, A.K., Kuehl, S. and Flickenschild, M., 2021. *Impacts of the COVID-19 pandemic on EU industries*. European Parliament.
- de Sousa Jabbour, A.B.L., Jabbour, C.J.C., Hingley, M., Vilalta-Perdomo, E.L., Ramsden, G. and Twigg, D., 2020. Sustainability of supply chains in the wake of the coronavirus (COVID-19/SARS-CoV-2) pandemic: lessons and trends. *Modern Supply Chain Research and Applications*.
- Fontell, Paula, and Pirjo Heikkilä. "Model of circular business ecosystem for textiles." (2017).
- Ferreira, C., Cardoso, C., Travassos, M., Paiva, M., Pestana, M., Lopes, J.M. and Oliveira, M., 2021. Disorders, Vulnerabilities and Resilience in the Supply Chain in Pandemic Times. *Logistics*, 5(3), p.48.
- Fabbe-Costes, N. and Ziad, Y., 2021, July. Improving Supply Chain Robustness & Resilience? Lessons from a case study in the automotive industry during the first wave of Covid-19. In *28th EurOMA Conference-5-7 July 2021*.
- Freeman, R.E., Harrison, J.S., Wicks, A.C., Parmar, B.L. and De Colle, S., 2010. Stakeholder theory: The state of the art.
- Farhana, K., 2014. Ready-made garments in Bangladesh: No longer a forgotten sector. *Organisation for Economic Cooperation and Development. The OECD Observer*, (299), p.11.
- Griggs, D.J., Nilsson, M., Stevance, A. and McCollum, D., 2017. *A guide to SDG interactions: from science to implementation*. International Council for Science, Paris.

- Galvez, J.F., Mejuto, J.C. and Simal-Gandara, J., 2018. Future challenges on the use of blockchain for food traceability analysis. *TrAC Trends in Analytical Chemistry*, 107, pp.222-232.
- Gereffi, G., 2020. What does the COVID-19 pandemic teach us about global value chains? The case of medical supplies. *Journal of International Business Policy*, 3(3), pp.287-301.
- Golan, M.S., Jernegan, L.H. and Linkov, I., 2020. Trends and applications of resilience analytics in supply chain modeling: systematic literature review in the context of the COVID-19 pandemic. *Environment Systems and Decisions*, 40, pp.222-243
- Golay, E., 2021. Recycled fibers for circular economy-The case of the fashion industry.
- Geyskens, I., Steenkamp, J.B.E. and Kumar, N., 2006. Make, buy, or ally: A Stakeholder theory meta-analysis. *Academy of management journal*, 49(3), pp.519-543.
- Gandasari, D. and Dwidienawati, D., 2020. Content analysis of social and economic issues in Indonesia during the COVID-19 pandemic. *Heliyon*, 6(11), p.e05599.
- Gustafsson, J., 2017. Single case studies vs. multiple case studies: A comparative study.
- Hill, C.W., 1990. Cooperation, opportunism, and the invisible hand: Implications for transaction cost theory. *Academy of management review*, 15(3), pp.500-513.
- Hastig, G.M. and Sodhi, M.S., 2020. Blockchain for supply chain traceability: Business requirements and critical success factors. *Production and Operations Management*, 29(4), pp.935-954.
- Hossain, M.I., Polas, M.R.H., Rahman, M.M., Islam, T. and Jamadar, Y., 2020. An exploration of COVID-19 pandemic and its consequences on FMCG industry in Bangladesh. *Journal of Management Info*, 7(3), pp.145-155.
- Ha-Brookshire, J. and Norum, P., 2011. Cotton and sustainability: Impacting student learning through Sustainable Cotton Summit. *International Journal of Sustainability in Higher Education*.
- Hossain, M. and Nath, N.C., 2020. Analysis of Trade Pattern, Market Access and Trade Potential in Bangladesh. *Bangladesh's Macroeconomic Policy: Trends, Determinants and Impact*, p.267.
- Hossain, M.U. and Roy, I., 2016. Supply chain management for sustainable RMG growth in Bangladesh. *International Journal of Science and Research*, 5(4), pp.1242-1248.
- Haider, M.Z., 2007. Competitiveness of the Bangladesh ready-made garment industry in major international markets. *Asia-Pacific Trade and Investment Review*, 3(1), pp.3-27.
- Ivanov, D. and Dolgui, A., 2020. A digital supply chain twin for managing the disruption risks and resilience in the era of Industry 4.0. *Production Planning & Control*, pp.1-14.
- Islam, M.S., 2021. Ready-made garments exports earning and its contribution to economic growth in Bangladesh. *GeoJournal*, 86(3), pp.1301-1309.

- Isen, M.M., 2012. *Developing a sustainable procurement strategy for fashion buyers in the German retail sector*. diplom. de.
- Ivanov, D. and Das, A., 2020. Coronavirus (COVID-19/SARS-CoV-2) and supply chain resilience: A research note. *International Journal of Integrated Supply Management*, 13(1), pp.90-102.
- Ivanov, D., 2020. Viable supply chain model: integrating agility, resilience and sustainability perspectives—lessons from and thinking beyond the COVID-19 pandemic. *Annals of Operations Research*, pp.1-21.
- Iivari, N., Sharma, S. and Ventä-Olkkonen, L., 2020. Digital transformation of everyday life—How COVID-19 pandemic transformed the basic education of the young generation and why information management research should care?. *International Journal of Information Management*, 55, p.102183.
- Jay, J.W.E. and Levy, M.A., 2018. Environmental performance index.
- Jaipuria, S. and Mahapatra, S.S., 2014. An improved demand forecasting method to reduce bullwhip effect in supply chains. *Expert Systems with Applications*, 41(5), pp.2395-2408.
- Johnsen, T.E., Miemczyk, J. and Howard, M., 2017. A systematic literature review of sustainable purchasing and supply research: Theoretical perspectives and opportunities for IMP-based research. *Industrial Marketing Management*, 61, pp.130-143.
- Juan, S.J., Li, E.Y. and Hung, W.H., 2021. An integrated model of supply chain resilience and its impact on supply chain performance under disruption. *The International Journal of Logistics Management*.
- Karmaker, C.L., Ahmed, T., Ahmed, S., Ali, S.M., Moktadir, M.A. and Kabir, G., 2021. Improving supply chain sustainability in the context of COVID-19 pandemic in an emerging economy: Exploring drivers using an integrated model. *Sustainable production and consumption*, 26, pp.411-427.
- Kumar, M.S., Raut, R.D., Narwane, V.S. and Narkhede, B.E., 2020. Applications of industry 4.0 to overcome the COVID-19 operational challenges. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, 14(5), pp.1283-1289.
- Khanzada, H., Khan, M.Q. and Kayani, S., 2020. Cotton Based Clothing. In *Cotton Science and Processing Technology* (pp. 377-391). Springer, Singapore.
- Kabir, H., Maple, M. and Usher, K., 2021. The impact of COVID-19 on Bangladeshi readymade garment (RMG) workers. *Journal of Public Health*, 43(1), pp.47-52..
- Leal Filho, W., Azeiteiro, U., Alves, F., Pace, P., Mifsud, M., Brandli, L., Caeiro, S.S. and Disterheft, A., 2018. Reinvigorating the sustainable development research agenda: the role of the sustainable development goals (SDG). *International Journal of Sustainable Development & World Ecology*, 25(2), pp.131-142.
- Karlsson, H.M., 2011. *Integration of Social Responsibility into the Norwegian Environmental Certification Scheme Eco-Lighthouse (Miljøfyrtårn): A comparison with ISO 26000 Guidance on social responsibility* (Master's thesis, Institutt for industriell økonomi og teknologiledelse).

- Kinda, R.S., Zidouemba, P.R. and Ouedraogo, I.M., 2020. How could the Covid-19 pandemic impact the economy of Burkina Faso. *Economics Bulletin*, 40(3), pp.2034-2046.
- Lotfi, M. and Saghiri, S., 2019. Disentangling resilience, agility and leanness: Conceptual development and empirical analysis. *Journal of Manufacturing Technology Management*.
- Muhammad, A., 2011. Wealth and deprivation: Ready-made garments industry in Bangladesh. *Economic and Political weekly*, pp.23-27.
- Miah, G., Bari, N. and Rahman, A., 2010. Resource degradation and livelihood in the coastal region of Bangladesh. *Frontiers of Earth Science in China*, 4(4), pp.427-437.
- Morecroft, M.D., Crick, H.Q., Duffield, S.J. and Macgregor, N.A., 2012. Resilience to climate change: translating principles into practice. *Journal of Applied Ecology*, 49(3), pp.547-551.
- Moin, C.J., Iqbal, M., Malek, A.A. and Haque, R., 2020. Time-Based Process Mapping for Lead Time Compression in the Apparel Supply Chain: A Case Study. *International Journal of Mathematical, Engineering and Management Sciences*, 5(1), pp.96-107.
- Mao, H. and Görg, H., 2020. Friends like this: The impact of the US–China trade war on global value chains. *The World Economy*, 43(7), pp.1776-1791.
- Manchanda, S., Schlorke, S. and Schmitt, M., 2020. Innovation, Investment, and Emerging Opportunities in Today's Textile and Apparel Value Chain.
- Modgil, S., Singh, R.K. and Hannibal, C., 2021. Artificial intelligence for supply chain resilience: learning from Covid-19. *The International Journal of Logistics Management*.
- Moosavi, J. and Hosseini, S., 2021. Simulation-based assessment of supply chain resilience with consideration of recovery strategies in the COVID-19 pandemic context. *Computers & Industrial Engineering*, 160, p.107593.
- Matawale, C.R., Datta, S. and Mahapatra, S.S., 2013. Interrelationship of capabilities/enablers for lean, agile and leagile manufacturing: an ISM approach. *International Journal of Process Management and Benchmarking*, 3(3), pp.290-313.
- McMaster, M., Nettleton, C., Tom, C., Xu, B., Cao, C. and Qiao, P., 2020. Risk management: Rethinking fashion supply chain management for multinational corporations in light of the COVID-19 outbreak. *Journal of Risk and Financial Management*, 13(8), p.173.
- Mahyuni, L.P., Adrian, R., Darma, G.S., Krisnawijaya, N.N.K., Dewi, I.G.A.A.P. and Permana, G.P.L., 2020. Mapping the potentials of blockchain in improving supply chain performance. *Cogent Business & Management*, 7(1), p.1788329.
- Makhdum, A.H., Khan, H.N. and Ahmad, S., 2011, February. Reducing cotton footprints through implementation of better management practices in cotton production; a step towards Better Cotton Initiative. In *Proceedings of the Fifth Meeting of the Asian Cotton Research and Development Network, Lahore, Pakistan* (pp. 23-26).

- Muthu, S.S. ed., 2017. *Sustainability in Denim*. Woodhead Publishing.
- Moktadir, M.A., Rahman, T., Rahman, M.H., Ali, S.M. and Paul, S.K., 2018. Drivers to sustainable manufacturing practices and circular economy: A perspective of leather industries in Bangladesh. *Journal of Cleaner Production*, 174, pp.1366-1380.
- Naher, N., Hassan, M.S., Hoque, R., Alamgir, N. and Ahmed, S.M., 2018. Irregularities, informal practices, and the motivation of frontline healthcare providers in Bangladesh: current scenario and future perspectives towards achieving universal health coverage by 2030. *ACE SOAS Consortium Working Paper*, 4.
- Niinimäki, K., Peters, G., Dahlbo, H., Perry, P., Rissanen, T. and Gwilt, A., 2020. The environmental price of fast fashion. *Nature Reviews Earth & Environment*, 1(4), pp.189-200.
- Nguyen, H.K. and Vu, M.N., 2021. Assess the Impact of the COVID-19 Pandemic and Propose Solutions for Sustainable Development for Textile Enterprises: An Integrated Data Envelopment Analysis-Binary Logistic Model Approach. *Journal of Risk and Financial Management*, 14(10), p.465.
- Nandi, S., Sarkis, J., Hervani, A. and Helms, M., 2020. Do blockchain and circular economy practices improve post COVID-19 supply chains? A resource-based and resource dependence perspective. *Industrial Management & Data Systems*.
- Oncul, K., 2021. Quality optimization and process capability analysis of ring spun Supima cotton yarn. *Materials Testing*, 63(10), pp.943-949.
- Pereira, C.R., Christopher, M. and Da Silva, A.L., 2014. Achieving supply chain resilience: the role of procurement. *Supply Chain*
- Patelli, N. and Mandrioli, M., 2020. Blockchain technology and traceability in the agrifood industry. *Journal of Food Science*, 85(11), pp.3670-3678.
- Pal, H., Chatterjee, K.N. and Sharma, D., 2017. Water footprint of denim industry. In *Sustainability in Denim* (pp. 111-123). Woodhead Publishing.
- Periyasamy, A.P., Wiener, J. and Militky, J., 2017. Life-cycle assessment of denim. In *Sustainability in denim* (pp. 83-110). Woodhead Publishing.
- Raihan, A., 2002. Contribution of the RMG Sector to the Bangladesh Economy.
- Rahman, M.H. and Siddiqui, S.A., 2015. RMG: prospect of contribution in economy of Bangladesh. *International Journal of Scientific and Research Publications*, 5(9), pp.1-8.
- Rahman, M.M. and Kashem, M.A., 2017. Carbon emissions, energy consumption and industrial growth in Bangladesh: Empirical evidence from ARDL cointegration and Granger causality analysis. *Energy Policy*, 110, pp.600-608.
- Rahaman, M.T., Pranta, A.D., Chandrow, O., Das, N.C., Khatun, M.D., Arafat, M.Y. and Sami, W.B.B., 2021. COVID-19 Pandemic and the Future of China-Plus-One Strategy in Apparel Trade

- Rusi, T., 2019, July. Applicability of Resilience Metrics in the Context of Telecommunications Services. In *European Conference on Cyber Warfare and Security* (pp. 845-XVIII). Academic Conferences International Limited.
- Ruiz-Benítez, R., López, C. and Real, J.C., 2018. The lean and resilient management of the supply chain and its impact on performance. *International Journal of Production Economics*, 203, pp.190-202.
- Rajesh, R., 2021. Flexible business strategies to enhance resilience in manufacturing supply chains: an empirical study. *Journal of Manufacturing Systems*, 60, pp.903-919.
- Rahman, K.M. and Chowdhury, E.H., 2020. Growth Trajectory and Developmental Impact of Ready-Made Garments Industry in Bangladesh. *Bangladesh's Economic and Social Progress*, pp.267-297.
- Rose, J., 2021. The Accord and the Alliance of Bangladesh: An Analysis of Factory Safety Data and Insights into their Inspection Systems.
- Rudenko, I., Bekchanov, M., Djanibekov, U. and Lamers, J.P.A., 2013. The added value of a water footprint approach: Micro-and macroeconomic analysis of cotton production, processing and export in water bound Uzbekistan. *Global and Planetary Change*, 110, pp.143-151.
- Rajesh, R., 2021. Flexible business strategies to enhance resilience in manufacturing supply chains: an empirical study. *Journal of Manufacturing Systems*, 60, pp.903-919.
- Rajak, S., Mathiyazhagan, K., Agarwal, V., Sivakumar, K., Kumar, V. and Appolloni, A., 2021. Issues and analysis of critical success factors for the sustainable initiatives in the supply chain during COVID-19 pandemic outbreak in India: A case study. *Research in Transportation Economics*, p.101114.
- Ruggeri, G. and Corsi, S., 2021. An Exploratory Analysis of the FAIRTRADE Certified Producer Organisations. *World*, 2(4), pp.442-455.
- Rametsteiner, E. and Simula, M., 2003. Forest certification—an instrument to promote sustainable forest management?. *Journal of environmental management*, 67(1), pp.87-98.
- Rusinek, M.J., Zhang, H. and Radziwill, N., 2018. Blockchain for a Traceable, Circular Textile Supply Chain: A Requirements Approach. *Software Quality Professional*, 21(1).
- Saunders, M.N., Lewis, P., Thornhill, A. and Bristow, A., 2015. Understanding research philosophy and approaches to theory developm
- Saha, P. and Mazumder, S., 2015. Impact of working environment on less productivity in RMG industries: A study on Bangladesh RMG sector. *Global Journal of Management And Business Research*.
- Saxena, S.B., 2014. *Made in Bangladesh, Cambodia, and Sri Lanka: the labor behind the global garments and textiles industries*. Cambria Press.
- Spieske, A. and Birkel, H., 2021. Improving supply chain resilience through industry 4.0: a systematic literature review under the impressions of the COVID-19 pandemic. *Computers & Industrial Engineering*, p.107452.

- Sandhiya, R., Boopika, A.M., Akshatha, M., Swetha, S.V. and Hariharan, N.M., 2021. Future of fashion industry: sustainable fashion using blockchain. *Blockchain 3.0 for Sustainable Development*, 10, p.145.
- Schrott, W. and Paul, R., 2015. Environmental impacts of denim manufacture. In *Denim* (pp. 563-580). Woodhead Publishing.
- Scott, A.J., 2006. The changing global geography of low-technology, labor-intensive industry: clothing, footwear, and furniture. *World Development*, 34(9), pp.1517-1536.
- Shen, Z.M. and Sun, Y., 2021. Strengthening supply chain resilience during COVID-19: A case study of JD. com. *Journal of Operations Management*.
- Sunyaev, A. and Schneider, S., 2013. Cloud services certification. *Communications of the ACM*, 56(2), pp.33-36.
- Tarigan, Z.J.H., Siagian, H. and Jie, F., 2021. Impact of Internal Integration, Supply Chain Partnership, Supply Chain Agility, and Supply Chain Resilience on Sustainable Advantage. *Sustainability*, 13(10), p.5460.
- Tripathi, G., Tripathi Nautiyal, V., Ahad, M.A. and Feroz, N., 2021. Blockchain Technology and Fashion Industry-Opportunities and Challenges. *Blockchain Technology: Applications and Challenges*, pp.201-220.
- Todeschini, B.V., Cortimiglia, M.N., Callegaro-de-Menezes, D. and Ghezzi, A., 2017. Innovative and sustainable business models in the fashion industry: Entrepreneurial drivers, opportunities, and challenges. *Business Horizons*, 60(6), pp.759-770.
- Thomas, D., 2019. The Real Cost of Your Blue Jeans; Making the industry's 80 billion garments per year requires huge amounts of water and toxic chemicals. It employs every sixth person on Earth--most in dangerous conditions for very little money. *Newsweek*, 173(8).
- Vanany, I., Ali, M.H., Tan, K.H., Kumar, A. and Siswanto, N., 2021. A Supply Chain Resilience Capability Framework and Process for Mitigating the COVID-19 Pandemic Disruption. *IEEE Transactions on Engineering Management*.
- Villena, V.H., 2019. The missing link? The strategic role of procurement in building sustainable supply networks. *Production and Operations Management*, 28(5), pp.1149-1172.
- Velayutham, A., Rahman, A.R., Narayan, A. and Wang, M., 2021. Pandemic turned into pandemonium: the effect on supply chains and the role of accounting information. *Accounting, Auditing & Accountability Journal*.
- Wong, C.Y., Arlbjørn, J.S., Hvolby, H.H. and Johansen, J., 2006. Assessing responsiveness of a volatile and seasonal supply chain: A case study. *International Journal of Production Economics*, 104(2), pp.709-721.
- Wang, M.W., Zhou, M.Y., Ji, G.H., Ye, L., Cheng, Y.R., Feng, Z.H. and Chen, J., 2020. Mask crisis during the COVID-19 outbreak. *Eur Rev Med Pharmacol Sci*, 24(6), pp.3397-3399.

WANG, F. and FENG, Z.Y., 2009. Comparison between China's eco-textile standards and Oeko-Tex-□ standard [J]. *Dyeing & Finishing*, 10.

Wahga, A.I., Blundel, R. and Schaefer, A., 2018. Understanding the drivers of sustainable entrepreneurial practices in Pakistan's leather industry: A multi-level approach. *International Journal of Entrepreneurial Behavior & Research*

Wagaye, B.T., Adamu, B.F. and Jhatial, A.K., 2020. Recycled Cotton Fibers for Melange Yarn Manufacturing. In *Cotton Science and Processing Technology* (pp. 529-546). Springer, Singapore.

Yukseler, H., Uzal, N., Sahinkaya, E.R.K.A.N., Kitis, M., Dilek, F.B. and Yetis, U., 2017. Analysis of the best available techniques for wastewaters from a denim manufacturing textile mill. *Journal of Environmental Management*, 203, pp.1118-1125.

Zambrano, M.C., Pawlak, J.J., Daystar, J., Ankeny, M. and Venditti, R.A., 2021. Impact of dyes and finishes on the aquatic biodegradability of cotton textile fibers and microfibers released on laundering clothes: correlations between enzyme adsorption and activity and biodegradation rates. *Marine Pollution Bulletin*, 165, p.112030.

Zhang, T., Zhai, Y., Ma, X., Shen, X., Bai, Y., Zhang, R., Ji, C. and Hong, J., 2021. Towards environmental sustainability: Life cycle assessment-based water footprint analysis on China's cotton production. *Journal of Cleaner Production*, p.127925.

Zhao, L. and Kim, K., 2021. Responding to the COVID-19 Pandemic: Practices and strategies of the global clothing and Textile value chain. *Clothing and Textiles Research Journal*, 39(2), pp.157-172.

Zhao, L. and Kim, K., 2021. Responding to the COVID-19 Pandemic: Practices and strategies of the global clothing and Textile value chain. *Clothing and Textiles Research Journal*, 39(2), pp.157-172.

Appendix :Interview guidelines (Semi Structured)

Preliminary Information (5 minutes)

I . Introduction of Interviewer

Purpose of the study

Data Confidentiality privacy declaration

ii. Interviewee position, background of the organization and experience in the industry

A) Initial Understanding of Sustainability in context of 3BL (20 minutes)

1)How is sustainability defined or viewed in your company and How Do you try to incorporate environmental consciousness in the company culture ?

2) To What extent is the environment included in your organizations business strategy? specifically procurement aspect.

3) Consider the following statement: "is it economically profitable to introduce environmental measures?".

In another sentence ,Do you think ,End customer are willing to pay for the sustainable products?

B) General questions about Supply chain resilience and innovation , Post pandemic (20 minutes)

1) How can sustainability in the supply chain be ensured through resilience in the context of the apparel supply chain of Bangladesh?

2)How technology can be applied in RMG industry to make every phase traceable to recycle materials from the circular economy perspective? * Particularly Blockchain

C) Drivers of Sustainable Procurement (15 minutes)

1)What are your criteria to selecting suppliers ? (During Pandemic)

2)How would you prioritize the levels of influence of the various drivers of sustainable procurement in your organization?

3)Would you say that your relationship with a certain supplier could have affected your procurement strategy(economic, environment or socio-political) in anyway? Some examples if possible?

4)If you were to advice someone who is about to start a career in procurement management, What are the key areas one should develop to achieve sustainability context in his role ?

-Anything you would like to share from your experience regarding sustainable procurement.

Thank you !