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"WHAT IS BEHIND THE BRAND? SOCIAL AND ENVIRONMENTAL SUSTAINABILITY IN THE UPSTREAM PHASES OF THE DENIM VALUE CHAIN"

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INTRODUCTION

Sustainability in the fashion industry represents a significant issue due to the environmental and social impacts associated to its sourcing, manufacturing and end-of-use processes (Ellen MacArthur Foundation, 2017). The global fashion industry is characterized by a complex set of industrial and professional activities which interact with each other, and in which the upstream suppliers and the downstream brands or retailers are collaborating together for the creation of the final garment. Most of the times, the final consumer associates the finished garment with the brands, however, behind big brands there are numerous upstream suppliers and workshops that manufacture the garments on behalf of brands and which are responsible of the sustainable practices related to the processes put in place to produce the final garment. The way they implement sustainable practices have an important effect on the whole industry. Today's challenge for high-end brands is to establish sustainable supply chain management systems, in order to demonstrate the presence of consistent principles and practices beyond what is transmitted by the logo.

The denim industry appears a representative industry to analyse the sustainability implementation, as it is one of the most polluting industries of the fashion system, due to the use of high quantities of chemicals, water and energy which affect the surrounding community, people and planet (Amutha, 2017). Globally four billion denim garments are produced each year and according to current research, this quantity is forecasted to grow by an average of 5% in the next years (Impact Institute, 2019). With total denim production on a continuous upward trajectory, the environmental and social footprint will create problems for the earth, society as well as for the industry players. Thus, sustainability is becoming a crucial topic. Since the denim value chain includes several suppliers specialized on a specific phase of production, the impact of a denim garment is the result of the individual actions of each player that contributed to its creation. So far, the literature addresses the topic of sustainability in the fashion industry in a general way and focusses mostly on lead buyers such as brands and retailers. The present thesis aims to contribute to the literature on sustainability by undertaking a value chain perspective which assess the environmental and social sustainability practices and approaches adopted by the upstream suppliers within the Italian denim value chain, the drivers pushing in the industry for sustainability, and suppliers' contribution in transforming the denim industry in a more sustainable, traceable and transparent one. To achieve this aim, both a quantitative and an explorative approach have been followed, which investigate the denim suppliers.

In the first chapter, the main goal is to define the general concept of the global and Italian fashion system and to represent the structure of the textile value chain. Since this thesis has the

aim to analyse the denim sector, an introduction and overview to the fashion system is a central point, in order to understand the characteristics and evolution of the fashion system, as well as the elements that compose it. Moreover, as the focus of the study is the Italian denim industry, an evaluation of the structure of the textile value chain and of the Italian fashion system is necessary to understand the context in which it operates.

The second chapter starts by describing the sustainability concept and the dimensions applied to fashion. After this introduction, the chapter continues by presenting the reasons why fashion companies have to adopt a more responsible approach and the drivers that push companies towards sustainability. Then, the environmental issues associated with the fashion systems are identified among the entire value chain, and the environmental sustainable practices available in the industry together with an overview of the Circular Economy and its approaches. The chapter continues with the presentation of the social issues deriving from the global fashion system and the practices to be adopted by brands to improve the performance. Lastly the role of technology as an enabler of sustainability improvement is investigated.

The third chapter introduces the sustainable supply chain management (SSCM) and the mechanisms through which to achieve it. Indeed, the governance mechanism, such as code of conducts, brand audits and certifications and standards, and their effectiveness to achieve SSCM are investigated. The chapter continues with an overview of the supply chain traceability and transparency and highlights their relevance for SSCM.

The fourth chapter starts with an introduction to the empirical analysis and to denim by presenting denim's characteristics and evolution. Indeed, this section analyses the context of the empirical analysis, which is the denim value chain, the Italian denim industry and the area of Veneto regarding the denim production. After this analysis, the Ghost Makers project is introduced, to whom the author of the thesis took part. Lastly, the aim of the thesis is presented and the methodology adopted to achieve this aim. The last chapter presents the findings of the quantitative analysis together with the implications for the Ghost Makers project. The quantitative analysis is followed by the qualitative analysis, where each case is presented and explored individually, and afterwards a cross-case analysis for each upstream phase of the denim value chain is performed. Finally a general analysis is carried out at the entire value chain level, including both the results of the quantitative and qualitative findings together. Based on the results, the implications for the brands are identified and the limitations of the study are presented together with the future research developments.

CHAPTER 1 – THE FASHION SYSTEM

1.1 An overview of the global fashion system

1.1.1 What is the "Fashion System"?

The fashion industry includes the design, manufacturing, distribution and marketing of all types of apparel, footwear, leather, jewelry, perfumes and accessories, ranging from "haute couture" fashion to "mass market" fashion (Culasso, Giacosa, & Mazzoleni, 2012; Arrigo, 2016). Fashion is, therefore, a broad term that tipically contains any good or market characterized by style as a relevant and transitory element (Macchion et al., 2015). Although the concept of "fashion" is applied to several sectors, its most frequent use is associated with apparel (Crane & Bovone, 2006; D'Amico, Giustiniano, Nenni, & Pirolo, 2013).

Talking about fashion, today, means facing in a global and analytical way not only the downstream levels in the supply chain, but also the upstream ones, starting from the creation of raw materials and finishing with product consumption. This allows to have a complete overview of the whole process and to identify relevant information about the players involved along the value chain: from fiber or leather to the finished garment or accessory. As a consequence, fashion reasoning naturally becomes a system reasoning, an absolutely new way of looking at the finished product, since it is able to include all the subjects who, with their work, contribute to its definition. Therefore, nowadays, the term "Fashion System" is preferred to that of the "Fashion Industry" (D'Amico et al., 2013). This work will use sometimes both terms as interchangeable.

According to Kawamura (2005), the fashion system is the result of a chain of decisions made by individuals interconnected within the various fashion industry niches (as cited in Crane & Bovone, 2006). It consists of a complex set of relationships between designers, manufacturers, cultural intermediaries, retailers, service providers and consumers (Crane & Bovone, 2006). Saviola & Testa (2000) and D'Amico et al. (2013) claim that the fashion system can be reputed as a "cluster", since it involves many firms operating in several economic sectors such as fibre, textile and clothing, leather, footwear, accessories, retailing and other supporting sectors, whose competitive advantage is reinforced by the links between them. This implies that the fashion system includes not only sectors belonging to the production and trade, but also sectors with a support function such as the service sector and the instrumental mechanics sector (Saviola & Testa, 2000; D'Amico et al., 2013).

The *manufacturing* component of the fashion system considers fibres, textile and leather processing and their transformation into finished products. The *retailing* component and the

trade activities in the fashion system are relevant for the value creation of the fashion products. The *instrumental mechanics* sector gives support to the textile industry. For istance, the presence of a qualified textile-mechanic industry and the close relationships between technology providers and textile manufacturers represent an occasion to innovate and create new fabrics and sustainable techniques (D'Amico et al., 2013). Among the support *services* of the fashion industry are the creative services connected to product design, communication and specialized press, special events, modeling agencies for fashion shows, organization of specialized fairs, customer relations, management and organizational consultancy services (Hermes lab, 2004). Therefore, a significant number of intermediaries such as designers, magazine editors, advertisers, event manager, etc. are playing a crucial role in tranforming clothing into fashion. The events that infleunce mostly the fashion system are presented by the organization of fashion weeks in the most important fashion capitals such as Milan, Paris, London and New York. Considering all these presented elements, "fashion" is the result of a dynamic and complex system of interconnections between different activities and phases which contribute to the creation of the success of the final product.

1.1.2 The evolution and characteristics of the current fashion system

The structure of the fashion value chain has seen transformations in terms of supply chain strategies and firm's integration in the past few decades. Historically, the global expansion of the fashion industry, and in particular of the apparel one, has been pushed by the trade policies. The Multi-Fiber Arrangement (MFA) that had governed the world trade from 1974 to 1994, and its successor the Agreement on Textiles and Clothing (ATC) established by World Trade Organization between 1995-2005, imposed quotas and preferential tariffs on apparel and textile items exported from developing countries to developed ones (Gereffi & Frederick, 2010). The aim of this trade policy was to protect the domestic industries of the United States and the European Union (EU), by limiting imports from highly competitive suppliers located in developing countries. However, it led to the fragmentation of the apparel value chain; developing countries that had already achieved their maximum quotas such as China, Taiwan, South Korea subcontracted the apparel manufacturing to Asian countries that owned unused export quotas such as Bangladesh, Vietnam and Sri Lanka (Gereffi & Frederick, 2010).

The removal of quotas, on first January 2005, together with the technological innovations and customer evolution accelerated the globalization of the fashion industry and contributed to the changes in its structure, industrial delocalization, fast fashion, mass customization and increased consumers' demand (Richero & Ferrigno, 2016; Gereffi & Frederick, 2010). Being

the apparel production one of the most labor-intensive activity which requires low technical innovation, garment sourcing decisions are mainly defined by the cost of the labor. Therefore, in search of low-cost production, fashion brands outsourced their labor-intensive phases of production from developed countries to low-income countries using manufacturers and subcontractors located in emerging countries like China, India, Vietnam, Bangladesh, etc., with the aim to offset the risk of volatility in the market and to increase their profit margins (Martino, Iannnone, Fera, Miranda, & Riemma, 2017). As a result, the modern fashion value chain consists of a fragmented, complex and globally dispersed network of suppliers, manufacturers, sub-contractors, intermediaries, managed by lead firms which are both large global retailers or brand owners in the fashion industry (Kumar, Hallqvist, & Ekwall, 2017b). Retailers and brands retain the design, distribution, marketing, forecasting and brand management activities, whereas the manufacturing activities are outsourcesd to a complex network of independent manufacturers, often located in several developing countries with different regulations. Often these manufacturers and suppliers are subcontracting work to other factories, in order to meet rigid deadlines or to execute additional steps, such as dyeing, finishing, embroidery, etc. (Ditty, Lovejoy, & Somers, 2019b). Despite non owning the production facilities, retailers operate as the leading actors in the value chain by having direct relationship with the costumers, forecasting the market demand, placing orders to the upstream suppliers and by capturing the highest portion of value (Kumar et al., 2017b). They may establish direct sourcing relationships with their suppliers or alternatively using an agent-sourcing model in which the links between the producers and brands in the value chain are established by traders or intermediaries that manage the production networks (Gereffi & Frederick, 2010). This transformation of the fashion system has created both opportunities and challenges for the workers. On one side, the globalization of the apparel supply chain has been a source of employment generation, but on the other side the competition among manufacturers in developing countries has led to harsh working conditions in the factories producing for international brands and retailers (Egels-Zandén & Lindholm, 2015). Moreover, the delocalization of production activities may result in reduced visibility, negative social and environmental impact and in issues related to the control of a complex chain of activities (Kumar et al., 2017b), especially in the current context of fast fashion.

The current fashion industry is, in fact, part of a fast changing environment in which consumers continuosly ask for higher quality, wider assortment of products, fashionable items and shorter lead times. (Martino et al., 2017). Unlike in the past, where consumers were less sensitive towards style and preferred basic apparel (Bhardwaj & Fairhurst, 2010), nowadays consumers

are continuously seeking for new trends and unique items. Traditionally, fashion was quite seasonal and consisted of the basic two collections of Spring/Summer and Autumn/Winter (Bhardwaj & Fairhurst, 2010). Nowadays, given the consumer desire for speed, newness, variety and style, fashion brands are continuosly widening the product range by updapting their offering and by becoming more responsive to the changing customer demand. As a result, more phases, the so-called "mid-seasons" have been added to the traditional seasons, hence producers have to manufacture products in small batches with reduced lead times (Bhardwaj & Fairhurst, 2010). The need for speed and newness is determined by the rapidity with which a fashion product becomes outmoded. Since fashion is considered a temporary dominant trend, the life cycle for fashion goods is becoming very short (Bhardwaj & Fairhurst, 2010). The products, in fact, are designed to catch the trend of the moment; they are introduced into the market and immediately adopted by fashion leaders, then their sales are increasing at a rapid growth until they achieve the peak of popularity and mass conformity, ending with the decline and the obsolescence of the fashion item (Martino, et al., 2017). Given this limited fashion product life-cycle from their introduction to decline, firms are risking to deal with obsolete materials and unsold items, thus influencing negatively their profitability. Moreover, fashion firms face an umpredictable and volatile market which is driven by very unstable events, such as weather, sport, movies, trends on social media, etc. (Martino, et al., 2017). Consumer's demand can change in a very short time, thus infleuncing firm's activity and product development process.

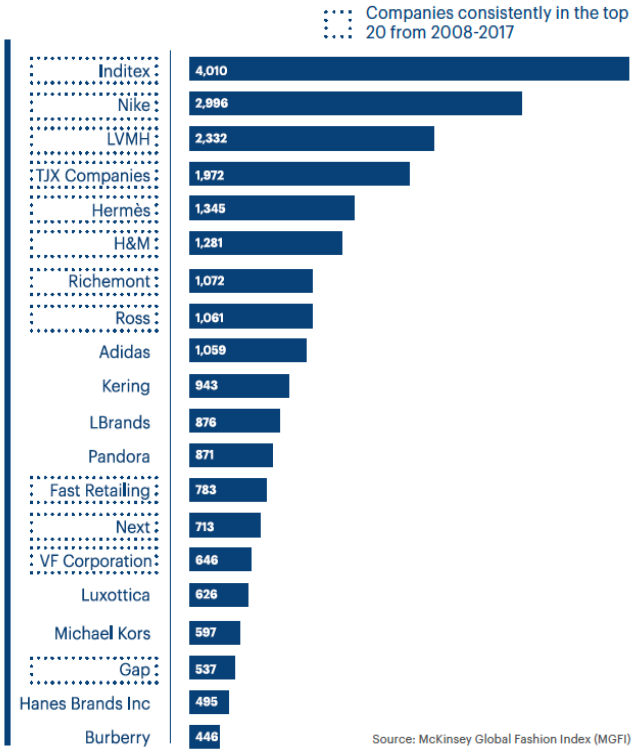
1.1.3 The relevance of the global fashion system

During recent decades, fashion has become an important industry for the global economy. It is, in fact, one of the world's largest consumer industries which generated in 2017 EUR 1.5 trillion in global revenue, including both apparel and footwear (Global Fashion Agenda & The Boston Consulting Group, 2018). After a good performance in 2018, the forecasted growth of the global fashion system for 2019 is of 3.5% to 4.5%, slightly below that of 2018, which was of 4-5% (McKinsey & Company, 2018). The slightly reduction in forecasts reflects the slower global growth, changes in trade policy, and the political and economic challenges in some parts of the world that are affecting the consumer spending.

The global fashion business is dominated by some leaders that contribute to the majority of the economic profit in the industry. According to McKinsey Global Fashion Index (2018), top 20 fashion companies generated 97% of industry economic profit[1] in 2017. This implies that these top companies are dominating the industry value, by increasingly investing in their brand image and in operational efficiency. Among the top leaders that stand out, there are mainly European

companies such as Inditex, LVMH, H&M and Kering followed by American companies like Nike, TJX Companies and Michael Kors. As can be noticed from *Figure 1*, the most resilient companies over time belong to the luxury segment (LVMH, Hermès, Richemont), fast fashion market (Inditex, H&M, Gap) and sportwear (Nike, VF Corporation).

Figure 1: Top 20 players in the fashion industry 2017, by economic profit $US million



*sour*ce: *McKinsey & Company (2018)*

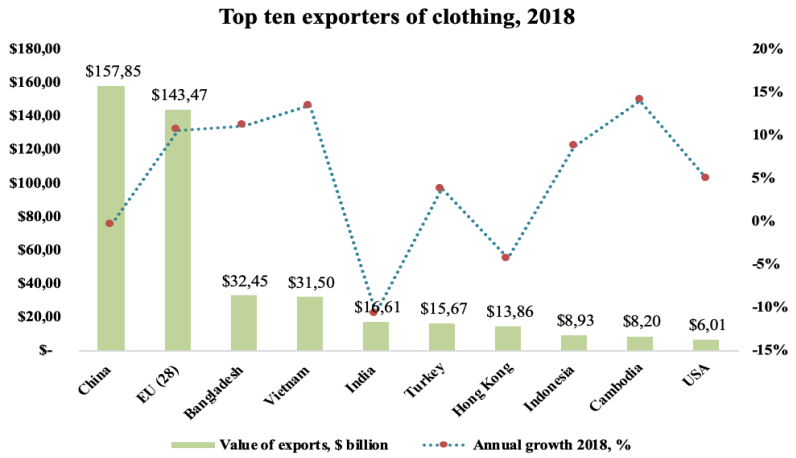
According to McKinsey & Company (2018) the Spanish fast fashion giant Inditex with $ 4 billion economic profit[1] is currently the biggest fashion company worldwide. Inditex owns fast fashion brands like Zara, Massimo Dutti, Pull&Bear, Stradivarius, Oysho, Bershka, Zara Home and Uterqüe. Zara, its largest brand, is present in 96 countries around the world with a chain of 2000 stores. Nike, an American multinational corporation offering sportwear, active wear and sports equipment, is the second largest fashion company worldwide. In 2017 Nike's economic profit was of almost $3 billion (McKinsey & Company, 2018). The majority of Nike's profit, nearly 90%, comes from the Nike brand and the remaining 10% comes from Converse, which is a subsidiary of Nike (FashionUnited Business Intelligence, 2019). The third largest fashion company worldwide is LVMH (Louis Vuitton Moët Hennessy), a French luxury conglomerate, with $2.33 billions of economic profit (McKinsey & Company, 2018). The company owns

[1] The Economic profit is the measure used for the value created by the business and is calculated as the difference between revenues received from the sale of the output and the costs of inputs used and opportunity costs.

several high-end fashion brands such as Louis Vuitton, Fendi, Dior, Céline and Givenchy. LVMH does not only operates in the high-end fashion, but owns brands representing luxury lifestyle, from champagne (Moët) to sailing yachts (Royal Van Lent) (FashionUnited Business Intelligence, 2019).

Since fashion is mostly associated with apparel (Crane & Bovone, 2006), a focus on apparel market is applied in order to analyze the size and the relevance of the fashion market. The map of global apparel production and consumption have changed significantly in the last years. As the number of middle-class individuals in emerging countries has increased, their purchasing power is improving by expressing their tastes through fashion (McKinsey & Company, 2018). In 2019, China is expected to overcome the USA and to become the largest fashion market in the world (McKinsey & Company, 2018). Therefore, China is no longer simply a country that produces low-cost apparel to the world and the largest exporter of apparel (World Trade Organization, 2019), but it is becoming one of the biggest consumer fashion market.

Figure 2: Top ten exporters of clothing, 2018



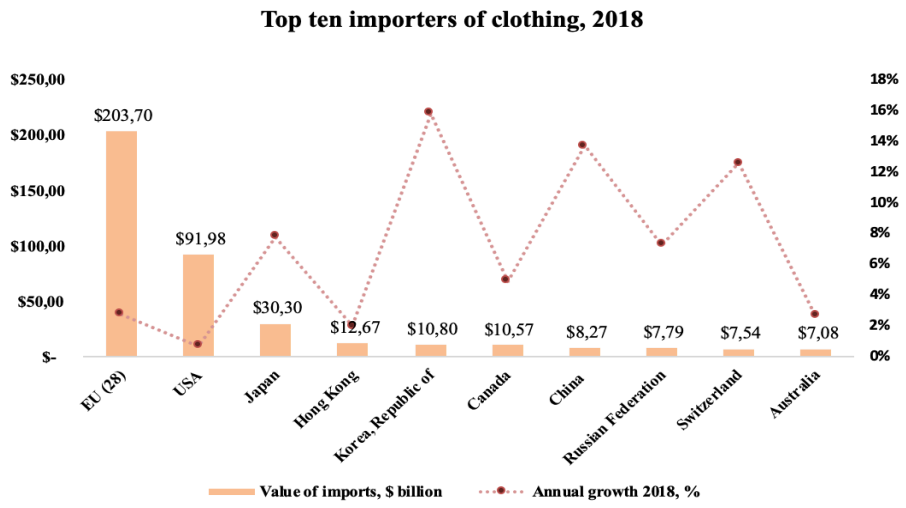
source: author's elaboration based on the data from World Trade Organization, (2019)

Compared to 2005, when China exported 71% of the apparel it produced; in 2017, the exports have declined to 47%, due to the increasing preferences of Chinese consumers for local brands and the delocalization of several US subsidiaries away from China as a result to the trade tariffs imposed to USA (McKinsey & Company, 2018). As a consequence, China started to lose its share in the world apparel exports and this led to the emergence of apparel producers' nations like Bangladesh, Vietnam, Cambodia, Turkey, where USA and EU fashion companies are sourcing their production. For instance, the statistics of the World Trade Organization (2019) (*Figure 2*) show that compared to 2017, the exports from Vietnam (up to 13%), Bangladesh (up to 11%) and Cambodia (up to 14%) have increased at a fast pace in 2018. Despite China's

declining exports with a slightly negative annual growth (-0.38%) in 2018, it still maintains its primacy in the world apparel exports. According to the last World Trade Statistical Review from World Trade Organization (2019) (*Figure 2*), China is the top exporter of clothing which accounts for 31.3% of world apparel exports in 2018, followed by EU (28)[2] with 28.4%, Bangladesh (6.8%) and Vietnam (6.4%) of share in the world clothing exports.

With regard to imports (*Figure 3*), EU (28)[2], USA and Japan remained the largest importers of clothing in 2018, by absorbing altogether 61.5% of world apparel. In the last years, these countries have reduced their manufacturing of apparel, thus becoming more depended on imports (McKinsey & Company, 2018). At the same time, several emerging economies like China, Russian Federation, Republic of Korea are increasing their apparel consumption, thus starting to import more. As shown in the graph (*Figure 3*) the Republic of Korea's apparel imports totaled $10.80 billion in 2018, with a growth of 16% compared to the year earlier; China's apparel imports showed a nearly 14% of annual growth; and Russia's clothing imports grew by 7% in 2018 (World Trade Organization, 2019). As consumers' purchasing power in emerging countries is improving, it can be expected the imports of apparel to change in the years ahead.

Figure 3: Top ten importers of clothing, 2018



source: author's elaboration based on the data from World Trade Organization, (2019)

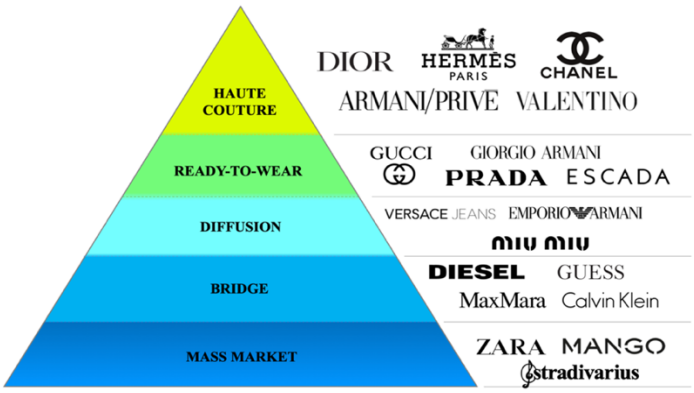
1.2 The fashion industry segments

Brands operating in the fashion industry can be distinguished in different segments based on the price of apparel, their quality and creativity, and the volume of their production. For the

[2] European Union includes all the 28 member States.

presentation of fashion segmentation, it is commonly used a fashion pyramid (*Figure 4*), going from a high-end/high-margin/low-volume top to a low-end/low-margin/high-volume bottom (Cillo & Verona, 2008). More precisely, the fashion industry can be divided into five segments: *Haute Couture, Ready-to-wear, Diffusion, Bridge* and *Mass market* (Cillo & Verona, 2008). Although the pyramid is presenting each layer as a single segment, nowadays, the boundaries between some layers are not that rigid as in the past. The following paragraphs will focus on the fast fashion typical of the mass market, and on the high-end segments.

Figure 4: The fashion pyramid



source: author's creation based on (Cillo & Verona, 2008; La Polo, 2018)

1.2.1 Fast fashion

The relevance and the development of the fast fashion phenomenon started approximatively in the last two decades, when the traditional fashion industry was challenged by globalization, changing customer demands and requirements for shorter lead times and lower costs (Turker & Altuntas, 2014). Until then, the fashion industry were following a fixed calendar of trade fairs and shows presenting the upcoming season. D'Amico et al. (2013) claim that the term "fast fashion" refers to the "*short time gap between the moment a new trend emerges and the moment the trendy product is available in shops*" (p.3). Whereas, Cimatti, Campana, & Carluccio, (2017) state that "fast fashion" is the term used to represent the low-cost clothing collections that imitate the luxury fashion trends.

Large fashion retailers, such as Zara, H&M and Mango, inspired by ready to wear fashion shows, manufacture clothing at low costs and make them available at an incredible speed to the customers (Crane & Bovone, 2006). Customers of fast fashion are mostly those who tend to change frequently their wardrobe and follow the trends, negleting the personalization, the composition and the quality of materials used. Unlike the luxury brands which are identified with the stylist's name (for example Armani, Versace etc.), the designers working in the fast fashion companies remain anonymous and the brand name is not associated with the designer's

name (Cimatti et al., 2017). These companies are mainly retailers which own a large network of external suppliers anywhere in the world, especially in emerging countries characterized by low-labour costs (Čiarnienė & Vienažindienė, 2014). Therefore, they are only performing in-house design, and are managing the supply chain, logistics and retail activities, and allocate the remaining phases of the production process to a network of low-cost suppliers (Culasso et al., 2012).

Unlike the high-end fashion manufacturing characterized by a push approach in which stylists decide the trends of the products, the fast fashion is characterized by a pull approach in which is the market that drives the clothing design and manufacturing (Arrigo, 2016). As fashion trends are changing at a faster pace, consumers ask for bigger variety of styles at low prices, and consequently firms are trying to respond to the fast changes in consumer demands through lead time reduction (Čiarnienė & Vienažindienė, 2014). The reduction of lead time implies that the stores are supplied more frequently with smaller batches of products, offering a wider range of fashion products (D'Amico et al., 2013). The fast fashion has replaced, in effect, the traditional two-collection model with a new model based on many mini-collections. For example, H&M realeses up to 16 collection per year, whereas Zara is able to produce up to 20 collections (Changing Markets Foundation, 2017). Moreover, as fast fashion aims to reduce the lead time, some stages of the value chain have been eliminated and the suppliers are pressured to be more flexible and responsive, but all of this at the expense of the quality of products (Čiarnienė & Vienažindienė, 2014). The achievement of an higher responsiveness to the market demand requires a flexible supply chain and closer cooperation between the players responsible for the different production phases, including fibre manufactureres, weavers, stylists, apparel manufacturers and other suppliers (D'Amico et al., 2013). By owning a flexible supply chain, applying rapid prototyping, using efficient and innovative logistic tools, and by manufacturing in small batches (Cimatti et al., 2017), companies such as Zara and H&M have reduced the standard turnaround time from months to few weeks (Turker & Altuntas, 2014). Therefore, the fast fashion industry is able to respond and fulfill quickly the customer demand maintaining at the same time a certain level of efficiency. If on one side, this type of structure allows to be responsive, on the other side, it becomes unsustainable by neglecting the ethical and environmental issues (Turker & Altuntas, 2014).

1.2.2 High-end fashion

The high-end fashion is associated with the upper segments of the fashion pyramid such as haute couture, ready to ware and diffusion fashion. The elements that characterizes the luxury fashion are: design signature, brand reputation, high price, product integrity, premium quality,

exclusivity, emotional appeal, service and culture (Carmignani & Zammori, 2015; Brun, et al., 2008). Brands operating in this market are continuously investing in quality standards and in innovation of styles and materials (Culasso et al., 2012). Examples of luxury fashion brands are Giorgio Armani, Gucci, Dior, Louis Vuitton, Valentino, Hermes etc., whose fashion products convey an idea of uniqueness, elegance, style and culture of design. Italy, France, UK and USA can be considered as a hub for luxury fashion, due to their established customer base, the creativity of their designers and the heritage of their many prestigious brands.

In the luxury segment the guarantee of the quality of fashion products is a key factor. The product quality is considered both in terms of superior material quality and in terms of premium manufacturing process, thus the sourcing of high-quality raw materials and components is relevant, and every phase of manufacturing process should comply to the desired standards. This implies that some specific materials have to be sourced in particular countries (for example: leather in Italy, crocodile leather in Australia, cashmere wool in India) and from certified suppliers (Brun, et al., 2008). Moreover, the manufacturing process of luxury fashion relies mostly on skilled labor of the artistic crafts which create a limited quantity of products accessible only to specific exclusive customers (Cimatti et al., 2017). The craftmanship represents, thus, a key element for the proof of high-quality products. However, high quality is not enough for the high-end fashion; products should also enclose style and aesthetics, in order to be perceived as unique by customers. Therefore, the design phase is the most relevant; usually luxury fashion has a design signature and relies on a qualified design team, and the brand is often associated with a famous designer's name as in the case of Versace or Giorgio Armani. Usually these companies are keeping in house the core competences related to product design (which decides the fabrics, style and the aesthetic elements of the products), planning and procurement, while outsourcing the non-critical manufacturing phases (sewing, finishing) to small manufacturing workshops (Brun et al., 2008; Gereffi & Frederick, 2010). Since many of the manufacturing phases are not performed in house, suppliers are carefully selected by brands and create with them long-term partnerships, in order to ensure the premium quality level. Furthermore, brands usually are controlling the suppliers' operations by applying an audit control, which allows brands to monitor the quality of the goods and the compliance to some specific standards of social responsibility (Towers, Perry, & Chen, 2013). This type of configuration of the value chain is very flexible, thus enabling luxury brands to deal with the uncertainty and the oscillating demand typical of fashion market.

The country of origin of the high-end fashion in some way influences the value perceived by the customer. In the case the high-end brand is known for the country of origin and it represents one of its success factors, then this implies that all the production phases, even when outsourced, should be performed in that specific country (Brun, et al., 2008). For example, the "Made in Italy" label for luxury brands is used as a guarantee of high-quality and creative design which justifies the premium price requested.

While for the mass fashion, operational efficiency and costs are the most critical factors, luxury brands tend to focus more on product differentiation and customization, and brand image. Of course, costs are also relevant, but are not critical, since customers are willing to pay a premium price which justifies the value and the benefits received (Brun, et al., 2008). Due to the need of high product customization and the creation of one item at a time, the lead time of luxury fashion is much longer than those of mass fashion. This implies that all the activities of the manufacturing process from design to delivery are anticipated, at least one year before the product is available in the points of sale (Carmignani & Zammori, 2015; Brun, et al., 2008). Many activities are coordinated previously the launch of a collection, such as the design, creation of models, prototypes and samples that are presented and screened by designers, manufacturers, fashion leaders, critics and retailers and ending with the first production launch. However, in the last years the consumers are becoming increasingly impatient (McKinsey & Company, 2017), thus even luxury companies are starting to increase their attention towards some elements adopted by fast-fashion business model in order to reduce the time to market of their products (Changing Markets Foundation, 2017). This trend has been adopted by luxury retailers such as Louis Vuitton which offers many small mini-collections (Environmental Audit Committee, 2019).

While in the upstream levels of the value chain, the fashion brands are relying mostly on outsourcing, for the downstream levels they pursue a downstream integration. The reason is the relevance to have a direct contact with the customers and to create an appealing shopping experience (Brun, et al., 2008). Indeed, Carmignani & Zammori (2015) state that the sense of uniqueness and the image of the brand are strengthened by an exclusive distribution network. For this reason, most of the times, luxury brands sell their products directly to the final point of sale, without depending on any distributors (Brun, et al., 2008).

1.3 The structure of the textile-apparel value chain

The value chain involves multiple players and activities connected through upstream and downstream linkages, due to the presence of various materials and fibers used, technologies

needed and end products to be created (Giacosa, 2011). We tend often to focus our attention on final products (apparel, shoes, eyewear etc.), but in practice, these products are the result of the interaction of a complex chain of processing steps. Thus, small, medium and large firms are performing different activities along the production chain, in which each one is adding value and contributes to the creation of the final product (Culasso et al., 2012). The textile value chain distinguishes between upstream phases of the production, which manufacture semifinished and finished goods (fibres, yarns, fabrics, garments), and downstream phases, which are responsible for the distribution of the final products (Saviola & Testa, 2000). The results of the downstream companies depend on the decisions taken by the upstream companies and vice versa. When a consumer buys a garment at a sales point, actually he has come into possession of the result of the joint operation of a variety of agents who have contributed to the value creation, including the stylist, his creative team, the fabric supplier, the production function, the marketing department, the intermediary, the advertising agency and the retailer (Giacosa, 2011). Any error made by one of these subjects could compromise the quality of the end product and, consequently, also the value created by the entire supply chain.

According to Saviola & Testa (2000), the fashion industry is made of two macro value chains: the *textile-apparel chain* and the *leather-footwear chain*. However, since the current study covers the denim industry, then the focus will be on the **textile-apparel chain** (*Figure 5*), which includes several stages that could be deemed as real sub-sectors (Saviola & Testa, 2000):

- Fiber sector;
- Textile sector;
- Apparel manufacturing sector;
- Distribution.

The fiber sector

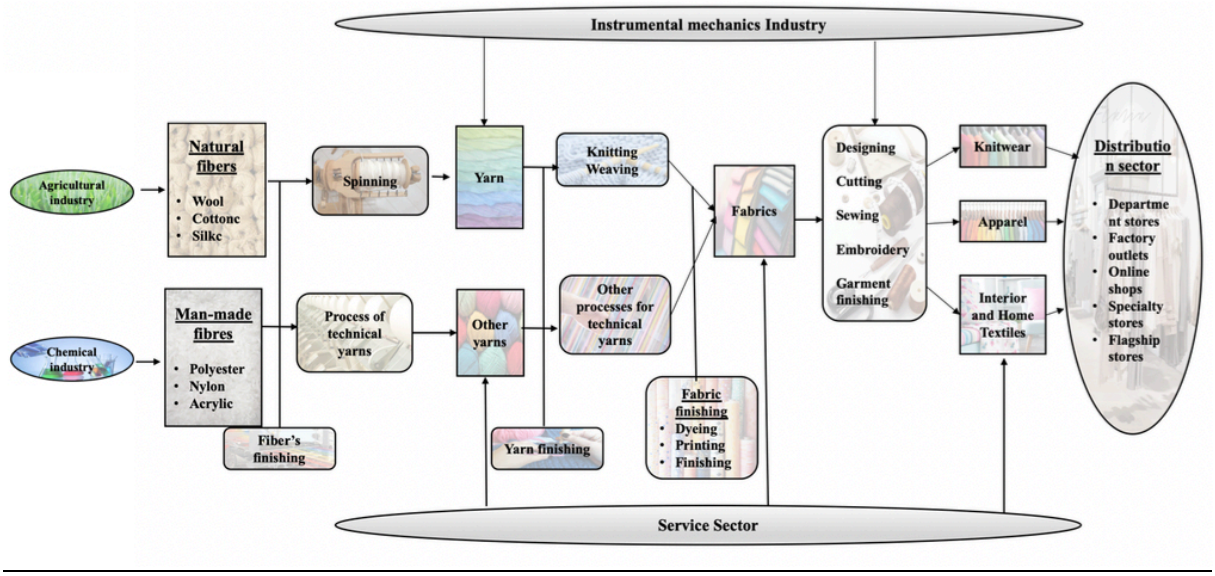
The fiber sector is producing the fibers, natural or "man-made", and is characterized by high innovation regarding the research of new functionalities and materials (Saviola & Testa, 2000), hence it requires high investments in R&D and technology. There are four types of fibers (Textile Exchange, 2018; Rex, Okcabol, & Ross, 2019):

- natural fibers which derive from animals such as *wool, silk* and *cashmere*, and they represent just 2% of the total global fiber production;
- natural plant fibers such as *cotton*, which is the second most important fiber with 24,5% of the total global fiber production, and other plant-based fibers including *jute, linen* and *hemp*, together have a market share of about 5%.

- man-made cellulosic (MMC) fibers such as *viscose, lyocell, acetate*, with a global production volume of about 6%; and
- man-made synthetic fibers such as *polyester* (51%) and *nylon* (5,4%).

Synthetic fibers are mostly produced from fossil oil, but they can also be produced from plants (for example corn or sugar cane) or from recycled PET bottles. Some of the most famous synthetic fibers are: polyester, acrylic, nylon and polypropylene. Man-made cellulosic fibers (called also regenerated fibers) can be produced from wood (eucalyptus), grass (bamboo) or from discarded textiles (Rex et al., 2019). The number of synthetic fibers is much higher than those of natural fibers, as they are developed in labs.

Figure 5: The structure of the textile-apparel value chain



source: author's adaption based on (Saviola & Testa, 2000)

The textile sector

The textile sector is performing the activities of transforming the fibers into yarns and fabrics by spinning, weaving, knitting or non-woven process (Şen, 2008). Hence, it can be segmented on the basis of the type of fiber used: from wool and cotton spinning, to silk weaving and processing of technical yarns.

The *spinning* phase consists of the transformation of fibers into yarns and semi-finished goods (Saviola & Testa, 2000). The *weaving* phase consists of the processing of yarns into textiles by interlacing lengthwise and widthwise the yarns at right angles (Şen, 2008). The chemical fibers are processed into textiles by using some particular processes which do not use any weaving loom (Saviola & Testa, 2000). The *finishing* phase consists of yarn and fabric treatments both in terms of dyeing or printing and in terms of other finishing processes. The finishing treatments include several chemical processes necessary for washing, drying, softening and polishing of

yarns, fabrics and apparel (Saviola & Testa, 2000). The *knitting* phase, instead implies the transformation of yarns into knitted fabrics or directly in a particular knitted sweater (Şen, 2008).

The apparel manufacturing sector

The apparel manufacturing starts with the design of garments which creates the pattern pieces. It includes activities such as fabric cutting, stitching, and finishing and the insertion of other components such as accessories, buttons, zippers and yarns (Şen, 2008). The garment finishing implies the dyeing, washing, ironing, inspection, trim, labelling and packaging. The apparel manufacturing activity can be *integrated*, with a firm that produces all the manufacturing phases, or *fragmented*, with small firms specialized on a specific stage of the production process. Moreover, it can be segmented on the basis of the type of the end product: fabric apparel and knitwear segment. The fabric apparel segment deals with fabric cutting and sewing, whereas the knitwear segment – with the manufacture of knitted garments from yarn (Saviola & Testa, 2000). Although often considered indistinctly as "clothing", the two types of product have, upstream, a big difference at the production-technological level but, despite these differences, they share some common sub-processes, which are designing, cutting, manufacturing, dyeing, ironing, quality check and packaging of the finished garment.

Distribution

The distribution represents the last part of the value chain and consists of the activity of labeling, packaging and selling the finished garment to the final customer. Though the distribution phase is localized at the end of the chain, it is considered the core of the textile-clothing chain, and more in general of the fashion system, as it represents the meeting point between the final customer and the offering of the entire value chain (Saviola & Testa, 2000).

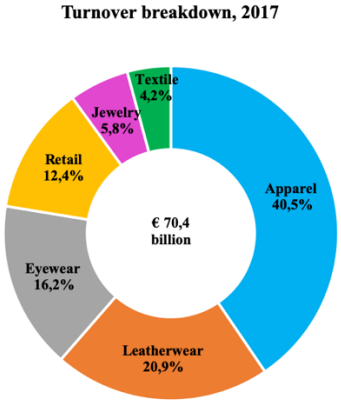
Nowadays, the rise of e-commerce challenges fashion firms and retailers to rethink the way they do retailing. The rise of digital retail channels and many online platforms has shifted the consumer purchase process from a traditional linear model to a more complex process across online and offline channels (McKinsey & Company, 2017). Regardless the type of selling points, customers expect a consistent brand experience at all times. Developing omnichannel capabilities and increasing the omnichannel integration by investing in e-commere and digital marketing are becoming central points for the fashion companies (McKinsey & Company, 2018).

1.4 The Italian fashion system

1.4.1 The features and structure of the Italian fashion system

The Italian fashion system represents an emblem of the national economy in terms of firms, workers and exports, which allows to assert the Made in Italy prestige worldwide. Acording to the report on fashion system by Area Studi Mediobanca (2019), the Italian fashions system is one of the key industry for the Italian economy; the aggregated turnover[3] generated by the Italian fashion system in 2017 was of EUR 70,4 billion and 40.5% of this turover belongs to the apparel sector, folowed by the leatherwear with 20,9% and eyewear with 16,2% (*Figure 6*). The textile sector generated in 2017 only 4,2% of the aggregated turnover.

Figure 6: The turnover breakdown of the Italian fashion system, 2017



Source: author's elaboration based on data from (Area Studi Mediobanca, 2019)

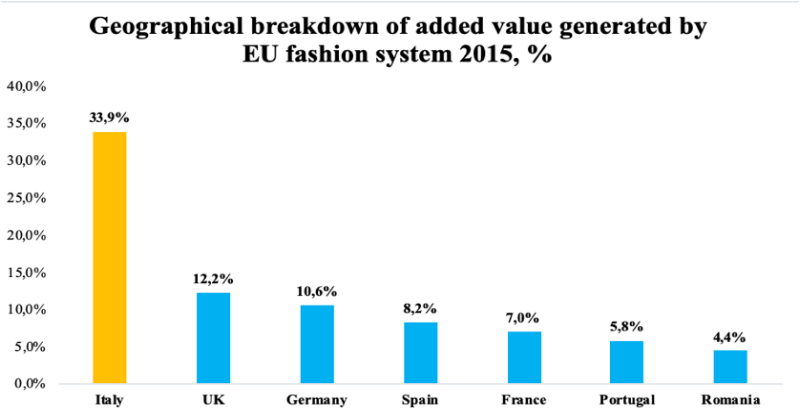
Moreover, in 2017 the Italian fashion system, which includes textiles, clothing, footwear and leatherwear, generated EUR 24.2 billion of added value which represents 10% of the total manufacturing added value, and employed around 500 thousand workers, or 15.5% of employees working in the Italian manufacturing as a whole (Direzione Studi e Ricerche di Intesa Sanpaolo, 2018). The Made in Italy fashion maintains its primacy and excellence not only at national level, but also in Europe, both in terms of production and added value. More than a third of the added value generated by the European Union's fashion system can be associated with Italy (33.9%) (*Figure 7*), a share equal to three times that of Germany and almost five times that of France (Direzione Studi e Ricerche di Intesa Sanpaolo, 2018). These positive numbers summarize the strengths of the Italian value chain configuration.

Even if, the fashion industry nowadays is highly globalized, with different value chain activities that could be performed in several countries, the research made by Macchion, Moretto, Caniato,

[3] It encompasses the turnover generated by the apparel, textile, leatherwear, retail, eyewear and jewelry sectors.

Caridi, Danese & Vinelli (2015), however, highlights that a relevant number of Italian fashion companies, still continues to work on a more localized and national scale. Many companies continue to get most of the value by maintaining their production it Italy, especially due to the presence of highly unique skills and craftmanship in the Italian districts, the avoidance of cultural and communication problems during the manufacture process and the lowering of logistic costs and lead time in production.

Figure 7: The geographical breakdown 2015 (EU leading manufacturers)



source: (Direzione Studi e Ricerche di Intesa Sanpaolo, 2018)

There are some specific characteristics that distinguish the Italian fashion companies from the rest of the firms in other countries and that make them to be the symbol of quality, elegancy and creativity at the international level (Culasso et al., 2012; Benini, 2016). Compared to the fashion systems in France or UK, the Italian fashion system is very fragmented. It is composed of some large firms, often multinational groups (Gucci, Ferragamo, Armani) that are investing in research and innovation and are operating at international level, and in parallel many small and medium firms, often artisans and with a family type structure (Culasso et al., 2012), specialized in one or more phases of the production process, and that mainly operate as contractors or subcontractors on behalf of others (Italian Textile Fashion, 2007). The small and medium enterprises are organized into numerous industrial districts, generally highly specialized on a specific type of product (textile, apparel, footwear). For instance, the industrial district of Prato is known for wool processing, Como – for silk, Vicenza – for wool and knitwear, etc. (*Table 5 in Appendix*). As a consequance, the Italian fashion system is characterized by a *network model* of organization of industrial, artizan and high-fashion firms that interact with each other directly or through intermediaries, where product design and manufacturing take place through collaborative and wide subcontracting relationships, and with a low degree of vertical integration (Crane & Bovone, 2006).

The way the fashion system is organized has also a relevant impact on creativity and innovation within the system. The inventiveness and flexibility which distinguish the Italian fashion system are, in fact, the result of the strong interconnections between textile companies, apparel firms, intermediaries and brands or retailers that are working together for the design and manufacturing of a wide range of innovtive products (Saviola & Testa, 2000; Italian Textile Fashion, 2007). An important element that contributed to the creativity within the system is the high level of innovation in the textile machinery sector, which produces plants and machinery for the transformation of raw materials and semi-finished products and for the finishing activities (Culasso et al., 2012). Therefore, due to the availability of these technologies, firms operating in the fashion system are able to adopt innovative and more sustainable techniques, thus increasing the product innovation and reducing the environemntal footprint.

1.4.2 Industrial districts

The Italian production scenario distinguishes by the presence of numerous industrial districts specialized in different segments and sectors of the fashion industry. These districts are characterized by a geographical concentration of small and medium enterprises, specialized on a particular type of production, that cooperate and compete concurrently, increasing their competitive advantage (D'Amico et al., 2013). In general, an industrial district is composed of independent firms which are integrated in a network of long term and cooperative relationships. In the *Table 5 in Appendix* are listed all the Italian textile – apparel and footwear districts and their related specialization categories.

The territorial proximity among companies favors processes of creation and transmission of knowledge and innovation. The innovative capacity of the companies, understood not so much as the ability to introduce radical innovations, through investments in research and development, but rather as the ability to improve continually their products and processes, thanks to their knowledge of the reference market, the mastery of a material or a production technique, the speed of information circulation and the collaboration (Ricciardi, 2013).

According to Porter (1998), manufacturing firms located in a district are more competitive than those located outside the district, due to the decrease in the lead time and transportation costs and to the elimination of cultural differences and communication problems (as cited in Macchion, et al., 2015). The competitiveness of industrial districts, therefore, originates from the spatial and temporal fragmentation of the production cycle into several processing steps, and the consequent specialization in the execution of each phase (Ricciardi, 2013). Although

companies operating within the district are often of small and medium size, they are able to achieve economies of scale and learning economies through the specialization of production phases, leading to an increase of their productivity.

Macchion, et al. (2015) claim that the most important factors connected to the companies' choices about the localization of their supply chain within the district are the "Made in Italy" label, product traceability and collaboration of suppliers. The "Made in Italy" is a valuable brand which distinguishes the Italian manufacturing and know-how everywhere in the world, with fashion being one of the its most representative fields (Culasso et al., 2012). The elements that characterize the "Made in Italy" are style, creativity, craftmanship, design, innovation, high quality, uniqueness and made to measure. All these "Made in Italy" capabilities and elements are present, cultivated and protected mainly in the local fashion districts (Macchion, et al., 2015). However, in the last years, the "Made in Italy" brand has risked to become more confused, due to the presence of many Chinese producers in Italy. For instance, the district of Prato has experienced a reduction of local textile firms and an increase of Chinese manufacturers (Lazzeretti & Capone, 2017).

Another element that characterizes the industrial districts is represented by the traceability of the supply chain network, which means that fashion brands and retailers can track their products starting from the suppliers of raw materials and ending with the selling points (Macchion, et al., 2015). Implementing traceability systems among agents that are located distantly from each other is more complex than keeping track of production activities performed within a local district. The product's traceability is a relevant as well as necessary activity for the clothing companies to reduce any risk related to the use of hazardous raw materials, to the manufacturing process or to unethical behaviors by the supply network actors that could compromise the company's reputation. Moreover, the district's configuration allow companies to collaborate with their suppliers, to share relevant mutual information and knowledge, and to be more flexible. Flexibility is expressed both by the capacity to adjust quickly the volumes and the production to the changing demands as well as by the possibility to search in the district for the most appropriate skills and capabilities between the widespread and available production capacities (Ricciardi, 2013).
Therefore, the opportunity to have access to a consolidated and collaborative network, allows, on one hand, large companies to effectively outsource part of the their production, dealing in this way with the environmental uncertainty and, on the other hand, to small businesses to obtain more easily economies of scale and clearly measurable performance advantages.

1.5 Discussion and future trends in the fashion system

The fast pace of the industry together with the changes in consumers' lifestyle are reorganizing the fashion system. In the last decades, the fashion industry sustained a considerable expansion and increase in competition, especially due to the globalization process, the introduction of new technologies and the shifting consumer's needs (McKinsey & Company, 2017). Thus, the fashion industry is increasingly dealing with uncertainty and volatility. To keep up with these changes, major fashion players are continuously innovating to enhance their productivity and resilience, as well as are accelerating the time from design to store, in the attempt to increase their responsiveness to the customer demand. Speed in production becomes critical to every fashion company and retailer, regardless of size and segment, and not just for the fast fashion retailers.

Furthermore, consumers became more aware about social and environmental causes and they have started to base their purchasing decision, in addition to the price, also on the practices adopted by the fashion companies. Therefore, the rise of the "sustainable fashion" phenomenon have induced brands to take a more active stance on social issues and to satisfy consumer demands for transparency and sustainability.

According to McKinsey & Company (2018), the fashion companies will start to look more proactively at opportunities coming from the changing trends in the market, rather than focusing on challenges ahead. This implies that fashion brands will strive to take advantage from the current issues, by transforming, for example, their business models in more sustainable ones or by using technology to improve the disclosure of relevant information to their customers. Therefore, the future trend in the fashion system for the companies is to create new strategies and models that are able to integrate the aesthetic, competitive and ethical fashion variables, while maintaining at center the individuals such as consumers, employees, suppliers and all the stakeholders.

CHAPTER 2 – SUSTAINABILITY ISSUES AND PRACTICES IN THE FASHION SYSTEM

2.1 Definition of sustainability

In literature the concept of sustainability is related to that of sustainable development. According to Brundtland et al. (1987), sustainable development "*is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs*" (as cited in Ukko, Saunila, Rantala, & Havukainen, 2019, p.322). This definition points out the three pillars of sustainable development, which are the *economic*, *social* and *ecological* dimensions. Sustainable development has received increased attention in the last years, so that on September 2015, United Nation member countries agreed on a universal agenda containing 17 UN Sustainable Development Goals (SDGs) to be achieved (Garcia-Torres, Albareda, Rey-Garcia, & Seuring, 2019). In addition, in the business management scope, sustainable development is generally put into prcatice through Elkington's tripple bottom line (TBL) concept, where performance is to be reached in the economic, social and environmnetal dimensions (Elkington, 1998, as cited in Garcia-Torres et al., 2019).

The *economic dimension* concerns the ability of a firm to maintain the capital and to generate continuous economic growth (Ukko et al., 2019). In particular, it represents the ability to reduce costs or to create added value through a more efficient use of available resources. Historically, the organizations were focusing mainly on this dimension and omitted the environmental and social dimensions.

The *environmental dimension* represents the ability to preserve over time the environment, by minimizing the use of toxic substances, resources and energy. It encompasses important factors such as energy and water consumption, land use, CO_2 emissions and waste generation. For the achievement of environmental sustainability, it is appropriate the use of renewable resources, the reduction of resource usage, dematerialization, the application of recycling, reuse and remanufacturing practices, etc. (Glavič & Lukman, 2007). However, the usage rate should not exceed the recovery rate and the consumption of non-renewable resources should not be superior the rate of renewable alternatives (Ukko et al., 2019). In the last years, environmental sustainability has become an important scope of industrial and economic development. Indeed, there is an interdependence between them; the way the economy is managed or a company operates impacts on the environment and environmental performance affects economic results, therefore environmental damage translates into economic losses (Khan, 1995).

The *social dimension* concerns the relationship between companies and their shareholders and focuses on factors such as health and safety issues, human capital development, job creation

and social aspects (Ukko et al., 2019). This dimension have received less attention, however its importance is starting to become increasingly relevant due to the globalization and delocalisation of the value chains.

The terms “sustainable" and “ethical” are becoming increasingly important in the current context of the fashion system. Indeed, the environmental dimension in the fashion industry includes all the actions that a firm could develop and implement to reduce the negative environmental impact generated by the fashion system, and translates in several movements such as eco-fashion, green fashion and circular fashion (Rinaldi & Testa, 2013). The concept of ethics, instead, regards mostly the impact of the fashion system on society. The social dimension, therefore, is connected to social community, workers and consumers and includes all the actions that a fashion brand could implement to respect the worker’s rights and to develop their capabilities, and to reduce the negative impact on local communities (Rinaldi & Testa, 2013). For a complete overview of a company’s activities, both social and environmental dimensions should be included in business operations and in interactions with stakeholders, influencing in turn the economic sustainability of the company. Therefore, *sustainable fashion* aims to achieve the sustainable goals and refers to the actions adopted by fashion players to balance the environmnetal protection and social responsibility with a good economic performance over time.

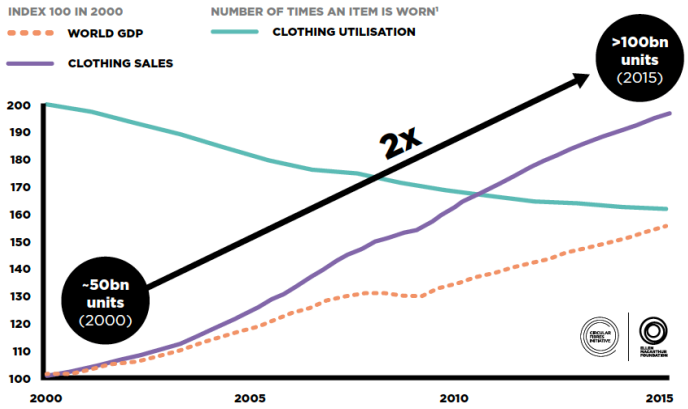
2.2 Why should fashion firms behave in a sustainable way?

2.2.1 The unsustainability of the current fashion system

The fashion industry is characterized by the rapidity with which its products get out of fashion. The rise of fast fashion, the changing consumer’s demands, the increase in the spending power and shorter production lead times are leading to overproduction and to a decrease in the useful life of apparel, generating excessive textile waste. According to Ellen MacArthur Foundation (2017), the clothing production has quite doubled in the last two decades (*Figure 8)*, encouraged by increased consumption and changing fashion trends. Recent research shows that on average an individual buys 60% more clothing items compared to 15 years ago (McKinsey & Company, 2018). Given the global scale and the high amount of natural and human resources necessary for the current production and consumption of fashion products, the fashion industry has a significative drawback for the environmental and social sustainability (Turker & Altuntas, 2014; Todeschini, Cortimiglia, Callegaro-de-Menezes, & Ghezzi, 2017). However, by boosting overconsumption of new apparel, it leads to a higher rate of clothing underutilization and waste; indeed Ellen MacArthur Foundation (2017) states that compared to the last two decades, the

rate of clothing utilization[4] considerably decreased by 36% (*Figure 8)* and consumers waste $460 billion of value annualy by dismissing clothes that could be still worn. A survey made by Barnardo, (2015) in Britain reveals that one in three young women consider clothes old after dressing them once or twice (as cited in McKinsey & Company, 2018). Furthermore, although several materials can be reused at the end of the their use, less than 1% of material used to produce clothing is recycled into new clothing at the end of its life (Ellen MacArthur Foundation, 2017). The low percentage of clothing utilization, the low levels of their recycling and the current wasteful production model puts increasing pressure on resources.

Figure 8: Growth of clothing sales and decline in clothing utilization



Source: Ellen MacArthur Foundation, (2017)

Besides the waste generated by consumers, there is also waste that is produced upstream by companies in the textile and apparel industry. The manufacturing processes in general, and in particular the processes of dyeing and finishing use a large amount of non-renewable resources and hazardous chemicals that have a negative environmental and social impact: chemicals to dye and finish textiles, water for the treatment of textiles, chemicals for the treatment of fibres, etc. (Cimatti et al., 2017; Franco, 2017). In addition to textile waste, the fashion consumption and production generates a rising demand for textile fibres. Nowadays, the production of polyester and other synthetic fibers has grown significantly and are dominating the industry. These synthetic fibers are made from non-renewable fossil fuels and require large amount of energy inputs and crude oil to be produced, thus releasing greenhouse gases. Moreover, since polyester is not biodegradable, the decompose process is very long (Koszewska, 2018). These fibres are also considered to be the major contributors to the issues of the plastic pollution of the oceans. The amount of plastic microfibres dismissed during the washing of plastic-based

[4] The average number of times a clothing is worn before it ends to be used (McKinsey & Company, 2017).

textiles, such as polyester, nylon, acrylic etc., which pollutes the ocean, is estimated to be around half a million tonnes annualy (Ellen MacArthur Foundation, 2017).

The globally-dispersed supply chain structure has a weight on the increase of CO_2 emmissions, especially due to the pressure on time impossed by fast fashion retailers, as they are located faraway from their supplies and the finished garments have to be delivered by air (Turker & Altuntas, 2014). In addition, the apprel producers are often located in countries where human rights are at risk and the labour standards are poor (Clean Clothes Campaign, 2019). Due to the increased time pressure imposed by the fast fashion industry, many workers are exploited and forced to work long-hours in unethical working conditions with low wages (Turker & Altuntas, 2014; Ellen MacArthur Foundation, 2017).

Therefore, the current way the garments are manufactured, used and disposed is becoming increasingly unsustainable. According to the reaserch carried out by Gloabl Fashion Agenda & The Boston Consulting Group (2019), the Pulse Score[5] that measures the sustainability of the industry for 2019 is of 42 out of 100. Although the score improved by four points with respect to the year earlier (38 points in 2018), it is considered still weak. Furthermore, the negative downsides of the fashion industry will drastically increase if the industry continues to follow its current path. By 2050, it is estimated that the consumption of non-renewable resources will increase up to 300 million tones per year and the amount of plastic microfibres will increase considerably (up to 20 million tonnes) (Ellen MacArthur Foundation, 2017). In addition to this, many fashion brands would face a decrease in EBIT margins, if they were to operate in the current way and regulations will be directed towards punishing those firms that do not act in a sustainable way. Additionaly, the negative outcome of the fashion system is becoming more transparent due to the more digitally-informed consumers, leading to reputational risks for brands. As a consequence, the reputation and the profitability of the whole industry will be at risk. Thus, a change of the industry is required at all its levels to improve the sustainability score of the industry.

2.2.2 Consumer awareness

The increasing consumer awareness about sustainability issues is becoming an important driver that leads companies to behave in a sustainable way (Todeschini et al., 2017). The occurrence

[5] The Pulse Score is a performance score in the fashion industry based on Sustainable Apparel Coalition's proprietary Higg Index, for measuring the sustainability of the fashion industry in terms of environmental and social impacts (Global Fashion Agenda & The Boston Consulting Group, 2018).

of tragic stories in garment sweatshops, abuses, child labour, poor working conditions, negative environmental impact, increased waste and industrial disasters have put pressure on fashion brands to behave more ethically and sustainable, and to be more transparent about their value chain activities. After the collapse of Rana Plaza garment factory, in Bangladesh in 2013, where more than 1100 people died, consumers started to put fashion brands under examination and to demand more information about how their products were manufactured and if they consider the environmental and social issues (McKinsey & Company, 2018).

Evidences of the consumer behavior change are translated in the increased interest in sustainable fashion, the consolidation of sharing and renting platforms, and in the tendency of younger generation to be more interested in access rather than ownership of goods (Todeschini, et al., 2017). Moreover, the creation of movements such "Who made my clothes" launched by Fashion Revolution aims to demand brands and retailers for more transparency and accountability for their supply chain (Ditty, Cook, Hunter, & Blanchard, 2019). Therefore, consumers are becoming increasingly conscious and interested in the sustainability and ethical practices of the fashion brands. According to the Consumer Survey report from Fashion Revolution (2018), among the five largest European markets, including Germany, United Kingdom, France, Italy and Spain, more than one in three consumers surveyed stated that they consider social (38%) and environmental impacts (37%) during their purchasing decisions. Likewise, McKinsey & Company (2018) states that consumer are encouraging the brands that behave responsibly, with 66% of individuals willing to spend more for sustainable products.

According to McKinsey & Company (2018), the current fashion industry experiences a trust deficit from its consumers. As trust is decreasing, consumers pay more attention when deciding the products of which brands to buy. Therefore, fashion brands are scrutinized based on the sustainability and transparency of their value chain, the treatment of their workers, authenticity, value for money and product integrity. This implies that brands should be coherent with their messages and actions, otherwise consumers are perceiving them as hyprocritical. The continuos access to information allows consumers to directly investigate the level of continuity between the communicated sustainability practices and brands' strategic and operational decisions (McKinsey & Company, 2018).

Currently, the Western markets are the most concerned about these issues. However according to McKinsey & Company (2018) in the coming years, it is expected that also consumers in other markets will be more dedicated to sustainability and increase their consciousness and

commitment, thus putting increasing pressure on companies to take active part in solving these issues.

2.2.3 Drivers for sustainability in the fashion system

Drivers act as pressures for the implementation of sustainability practices within the company's operations, depending on the company's culture and size. Commonly, the sustainability drivers are differentiated in *external*, which concern the relations with external stakeholders and result in reactive practices and *internal*, which are dealing with internal pressures and results in a more proactive approach (Lozano, 2015; Wahga, Blundel, & Schaefer, 2018).

Among the external drivers, the *national legislation* and regulation which requires compliance with certain standards is very common (Lozano, 2015). The government may impose stronger norms in order to push companies to engage in sustainable processes and products. However, the regulation pressure depends on the type of country the company operates. For instance, research from developing countries (Wahga et al., 2018) shows that the legislation is partially pushing for sustainability, hence it is a less effective driver for sustainable development. Compared to developed nations, where regulstions about legislation exist and are continuosly enforced, in developing countries there is a limited interest of the national government of these countries for the social and environmental issues and weaker enforcement of the standards. In the absence of an effective formal regulation, collaborations with *supporting institutions, NGOs* and *industry associations* are crucial in spreading sustainable practices implementation (Lozano, 2015). In the case of small size firms which are characterized by scarce financial resources and sustainability-oriented capabilities, the role of support institutions is fundamental in raising awareness, motivating, helping these firms to adopt innovative principles to reduce their footprint (Wahga et al., 2018). Education and training programmes and collaborations are useful in supporting the achievement of sustainable capabilities and mindset. *Customers'* and *market requirements* (market pull) and *industry dynamics* are other external drivers (Lozano, 2015). International lead firms and the environmental regulation of developed countries excert pressure on companies located in developed countries as well as emerging ones to become more responsible. Given the buyer-driven perspective of the global value chains, the sustainability strategies of the lead buyers and the standards imposed by them, influence the entire value chain. Moreover, the increasing pressure for sustainable products opens new market opportunities for firms that can develop new, eco-fiendly products.

Furthermore, examples of successful implementation of sustainable production processes may motivate other actors in the industry to engage with sustainability. Therefore, the localization

of a company within a network or district, can contribute to the exchange of sustainability knowledge and support among companies (Wahga et al., 2018). *Inter-firm collboration* between companies having a different level of sustainability implementation can encourage the less performed ones to adopt sustainable principles.

Among the internal drivers there are the *ethical leadership* and the *vision of entrepreneurs*, which are emphasized as the key factors for the successful implementation (Lozano, 2015; Wahga et al., 2018). This implies that if sustainability is part of the personal values of the owner or managers, it is more likely that they would implement sustainable practices within their business. The *competitiveness logic* which encompasses the resource savings, eco-efficiency, quality and economic benefits is another internal driver (Wahga et al., 2018). Sometimes, environmental and social sustainability is perceived by companies as an added value and a competitive advantage over their competitors. Enhanced *company reputation* is cited in literature as another internal driver (Lozano, 2015; Wahga et al., 2018). Since reputation can be translated into economic advantage, companies may strive to increase their image based on sustainability and responsible behaviour, by putting in place sustainable practices, hence increasing their legitimacy in the eyes of their stakeholders and broadening their market share.

In conclusion, a company may be driven by multi-level factors. This implies that the drivers are not singular, but there are several factors that could influence the company's behaviour (Wahga et al., 2018). Therefore, Lozano (2015) suggests a more hoalistic approach which considers simultaneously and complementarily all these drivers for sustainability principles.

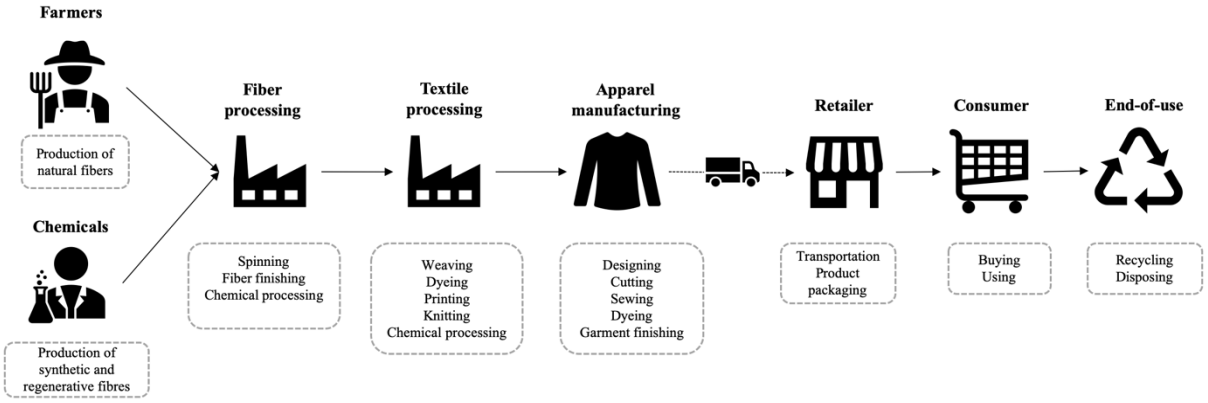
2.3 Fashion and environmental sustainability

Every fashion product has a cost in terms of water, land, energy, air and of other natural and non-renewable resources (Environmental Audit Committee, 2019). These costs are happening at all stages of the clothing life cycle from fiber production and garment manufacturing to its use and end-of-use (*Figure 9*). The type of fibres used, the way they are produced and transformed into yarns, the wet proccesses, the manufacturing process, the transportation and the clothing consumption and disposal, all have an environmental impact and contribute to the climate change.

The current fashion system is characterized mostly by a linear economic model of production which is following a take-make-dispose pattern (Ellen MacArthur Foundation, 2013). This implies that virgin resources and materials are extracted from the environment, transformed into products by applying energy, water and labor, and finally after products consumption they

are dismissed (Ellen MacArthur Foundation, 2017). This model is becoming increasingly unsustainable for the companies, environment and for the society as well, as it implies high resource and value losses and numerous negative environmental and societal impacts, threatening the fashion industry's growth. To overcome the issues created by the linear model and to create as little environmental and social costs as possible, fashion system should adopt a more circular economic model within its operations (Ellen MacArthur Foundation, 2017).

Figure 9: The stages of apparel life cycle together with the activities that have an environmental footprint



source: author's elaboration

2.3.1 The environmental issues deriving from the fashion system

When we speak about environmental sustainability, the fiber sector is the first to be responsible. The type of fibers and the mix of fibers used into a fabric or apparel, aside from the negative environmental impact (Jin & Cedrola, 2017), influence also the further clothing recycle. The fiber and the textile sectors make extensive use of water, energy and toxic chemicals for the cultivation of raw materials, textile processing and finishing of yarns and fabrics. Although cotton fibers are strong and biodegradable, their cultivation is a highly water intensive activity. Moreover, since the cotton growing makes use of fertilisers and pesticides, it also contaminates the locals water sources (WRAP, 2017). Environmental problems are associated not only with natural fibres but also with synthetic ones. Polyester fibers production makes use of high quantities of non-renewable resources and fossil energy (Ellen MacArthur Foundation, 2017). In addition, these fibers are non-biodegradable, and release plastic microfibres into biosphere and oceans during use (Rex et al., 2019). Viscose and other cellulosic fibres are the third most common fibres in the world, after oil-based synthetics and cotton. Since viscose is a plant-based fibre and is biodegradable, often it is marketed as an sustainable alternative for cotton and synthetic fibres, however, the research shows that the majority of viscose today is produced by

using toxic chemicals harmful for the health of local people (Changing Markets Foundation, 2017).

Textile processing, besides being water, energy and chemical intensive, creates also high amount of waste and by-products which most of the times are disposed through landfills (WRAP, 2017). The dyeing and printing process, instead, make use of different dyes, chemicals (acids, salts, etc.) and auxiliaries (surfactants and dispersing agents, etc.), resulting in wastewater, soil pollution and harm to health (Moazzem et al., 2018). The chemicals used in the textile processing often are retained in the finished garment, having an adverse effects on wearer by creating allergic reactions or respiratory deasease, or may be discharged into environment during washing or disposal (Ellen MacArthur Foundation, 2017).

The fashion industry is highly globalized, thus product transportation and distribution have a high impact on CO_2 emissions when products are transported from manufacturers to retailers or delivered home (Lawless & Medvedev, 2016). Moreover, sometimes the overproduction and the fast changing trends become a great issue for retailers. Many retailers, both luxury and fast fashion, are destroying the finished products they cannot sell by incinerating into landfills (Ditty et al., 2019). In 2018, for the sake of brand protection, Burberry burned $ 37.6 million worth of unsold clothes and accessories instead of selling them at a cheaper price (McKinsey & Company, 2018).

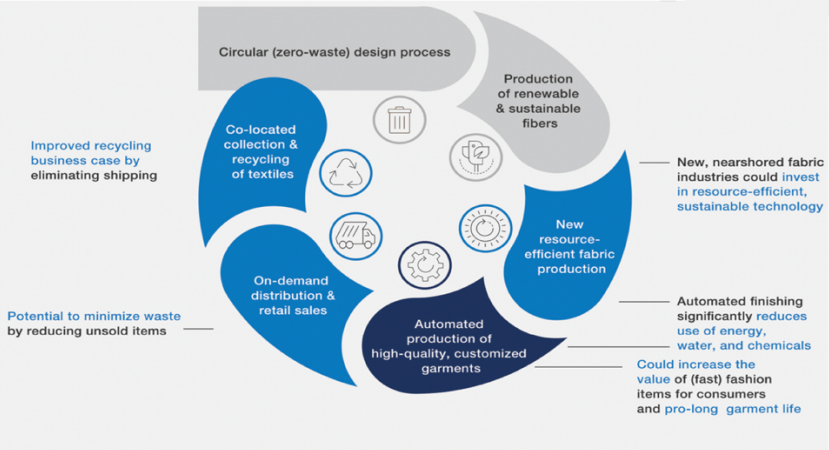
The produced clothing account for 3% of the global production of CO_2 emissions (Ditty et al., 2019). This weight depends not only on how apparel is manufactured, but also how consumers use it. About half of these emissions derives from clothing's wear, washing, tumble-drying, ironing and disposal (Lawless & Medvedev, 2016). Nowadays, consumers tend to use less a garment and dispose them just after being worn only few times. Globally, after clothing's use only a small part (25%) of garments is collected for reuse and recycling. Almost 75% of materials in used clothes are lost in landfills (Ellen MacArthur Foundation, 2017). Clothing's decomposition in a landfill, besides taking years and being harmful for the soil and water, it also release an harmful greenhouse gas methane into the environment (Ditty et al., 2019).

2.3.2 The shift to a Circular fashion

Ellen MacArthur Foundation (2013) states that circular economy (CE) "*is an industrial system that is restorative or regenerative by intention and design*" (p.7) which relies on renewable energy, elimination of hazardous substances from use, and zero-waste through the superior design of materials, products, processes and business models. Therefore, the circular economy

is a system that is designed and developed in a closed-loop way (*Figure 10*) with the aim to adress the negative economic, environmental and social impact.

Figure 10: The Circular apparel value chain



source: Andersson, et al. (2018)

According to Ellen MacArthur Foundation (2017), the CE is grounded on some important principles:

- **Design out waste and pollution:** A CE designs out the negative effects of economic activity that harms the human health and the environment. To ensure this, hazardous substances should be phased out by innovating the production processes, textile materials as well as to develop new inputs.
- **Keep products and materials in use:** A CE encourages activities that allow to keep the highest value of energy, materials and labor. This implies the design of products for durability, reuse, remanufacturing and recycling, in order to close the loop. Therefore, garments and textiles are used at their highest value, and after their use they re-enter the economy, without being dismissed as waste (Ellen MacArthur Foundation, 2017). At the same time, the CE is seeking to make a shift from the consumption of products to their use, hence it develops renting business models in which the ownership of a product is not transferred to the end consumer, but is preserved by the manufacturer or retailer which just sell the use of the product (Ellen MacArthur Foundation, 2013). This implies that the product is transformed into a service and allows for its multiple use. The development of rental and resale business models, besides being good business opportunities, can help to change the perception of clothing from being a disposable product to a more durable item.
- **Regenerate natural systems:** A CE preserves the resources and rely on renewable ones by using renewable energy. In a CE, materials are recovered from end-life products rather than

extracted, and products are designed in a way which allows their reuse, disassembly and refurbishment (Ellen MacArthur Foundation, 2013).

Mowing towards a circular fashion requires a high level of collaboration and commitment among all the actors, including industry players, governments and civil society (Ellen MacArthur Foundation, 2017). Industry players, regardless of size, have the primary role in this transition. Since brands and retailers are designing and selling clothing, they can contribute to the change by deciding the material composition, the number of collections and by influencing the purchasing behavior through their value proposition. The industrial players involved in collection, refurbishing and recycling can contribute to the change by developing new technologies and techniques that allows to maintain garments value within a closed-loop system. Furthermore, policymakers at different levels can create the conditions to facilitate the change to a circular approach through the introduction of binding policies or by creating incentives for the business and society (Ellen MacArthur Foundation, 2017). Indeed, the circular economy is supported by the EU and several national governments. On second December 2015, the EU Commission introduced the Circular Economy Action Plan which includes a package that sets the targeted actions to be adopted, in order to support the implementation of circular economy in each step of the value chain (European Commission, 2015).

2.3.3 Environmental practices in the fashion system

2.3.3.1 Product related sustainable practices

At the product level, the *use of sustainable raw materials* is a common practice among fashion firms. Although there is a limited availability of completely sustainable fabrics, manufacturers and designers can choose among organically grown, bio and recycled fibers (Lawless & Medvedev, 2016). The research by Rex et al. (2019) outlines that the best alternatives to conventional cotton that in some way meet its technical feasibility are Better Cotton Initiative (BCI) and certified organic cotton. The Better Cotton Initiative (BCI) consists in growing cotton with less harmful pesticides and more efficient irrigation (Rex et al., 2019), whereas the certified organic cotton, instead, avoids the use of pesticides and fertilisers (Ellen MacArthur Foundation, 2017).

The *development of innovative and bio-materials* is another practice that contributes to the sustainability of the products. Although in small-scale, in recent years several sustainable fibers have been developed and are emerging in the market, such as bamboo, orange fiber and other cellulosic fibers (Jin & Cedrola, 2017). While some of these innovations are still at lab level,

others have been already used by some brands. In 2017, Salvatore Ferragamo was the first fashion brand to use the Orange Fiber fabric for a Capsule Collection (Salvatore Ferragamo, 2017). However, to reduce the environmental costs created by the manufacturing of conventional fibers it is important for the alternative fibers to have a lower impact on environment and the same technical properties to displace conventional fibers, to be economically feasible, to be available in large quantities and to have the potential to go from lab scale to commercial scale without challenges (Rex et al., 2019).

Designers have to develop more durable products with low environmental impact, taking into account the production phases and the materials used, therefore considering the impact of the products right from the product design phase (WRAP, 2017). However higher durability could help to reduce the environmental cost, only if customers actually wear the clothes they buy for longer time and do not dispose them after few uses (Ellen MacArthur Foundation, 2017; WRAP, 2017). According to Ellen MacArthur Foundation (2017), clothing that is designed to be multi-purpose, changed and renovated over time could improve the number of times an item is worn. Designers can create modular clothing that can be adaptable to the changing consumer's tastes and can be restyled over time by users. For those customers that appreciate high-quality and durability, expecting products to last, brands can provide warranties to repair products that are broken or in-store repair services, thus increasing the product lifespan. For instance, Nudie Jeans offers a repair service for their damaged jeans, in order to make their jeans last longer (Global Fashion Agenda & The Boston Consulting Group, 2018).

An important step towards the improvement of the ecological footprint of the fashion products is the *elimination of the use of substances of concern* in every stage of garment production. Indeed, the DETOX campaign by Greenpeace is asking for the responsible use of chemicals. Where safer chemical alternatives exist, they have to replace the hazardous ones. Whether safer alternatives do not exist, new chemicals that meet both the functional specifications and the required safety for the environment and human health should be developed (Ellen MacArthur Foundation, 2017). However, an increased collaboration and transparency across the value chain on the substances used is needed in order to reduce the use of those of concern and to have access to better sourcing decisions. For instance, the ZDHC Roadmap to Zero Programme gathers together fashion brands, retailers, textile suppliers and associates committed to substitute the hazardous substances for safer ones in the production process to achieve the release of zero hazardous substances in the apparel value chain (ZDHC, 2017). The ZDHC created also a common Manufacturing Restricted Substances List (MRSL), containing a list of

toxic chemicals forbidden in textile and footwear sectors, and which can be adopted by the committed companies.

2.3.3.2 Process related sustainable practices

At the process level, the practices implemented by the companies are directed towards developing and *implementing more efficient processes in terms of use of energy and water, use of resources, waste creation and CO_2 emissions*. To achieve this, technology and material innovation are fundamental. To reduce the environmental load created by the dyeing and finishing processes, *low-impact techniques and machineries* are employed, such as natural dyeing or biodegradable dyes and digital printing (Lawless & Medvedev, 2016). Moreover, to reduce the wastewater resulting from the dyeing process, waterless dyeing solutions can be adopted. Examples include the AirDye technology that reduces significant waste in the garment lifecycle by saving up to 95% of the water, 86% of the energy, and 84% of the greenhouse gases as compared to conventional print and dye methods (Debs Textile Corporation, 2011). Another example is DyeCoo which offers water-free and chemical-free solutions for dyeing and printing (Ellen MacArthur Foundation, 2017). Moreover, producers are monitoring the wastewater from wet processing to ensure that is not harmful for the environment (Baptist World Aid Australia, 2019).

In manufacturing operations, different practices to reduce the water and energy can be adopted. Manufacturers can use more *energy efficient machines*, *change from conventional to renewable energy sources*, improve lightening by changing the light bulbs with low-carbon LED alternatives, use of rainwater for production, develop *wastewater treatment plants* and install meters to measure the energy and water consumption (Ellen MacArthur Foundation, 2017). Furthermore, the textile waste deriving from textile processing and garment manufacturing can be reduced through the creation of zero-waste patterns and reutilization of pattern scraps (Lawless & Medvedev, 2016) or by implementing more efficient production methods and processes which allows to reduce the offcuts. For instance, using offcuts on internal parts of a garment (for example: pockets, insides of collars, cuffs) or using offcuts for small details on the exterior part of a garment.

Brands, instead, can reduce the CO_2 emissions associated with the transportation by improving the efficiency of their distribution which implies reducing the distance between suppliers and consumer country or changing the type of transportation (Moazzem et al., 2018).

2.4 Fashion and social sustainability

The relationship between fashion and society is becoming increasingly relevant, as fashion brands and retailers are owning complex value chain located worldwide and consumers increase their awareness about their operations. Ethical fashion is the other element of the "Sustainable Fashion" and it considers several corporate social responsibility (CSR) issues on which a fashion brands and retailers can intervene to address them and to improve the relation with the society (Rinaldi & Testa, 2013). Joergens (2006) states that ethical fashion represent clothes that incorporate fair trade practices while avoiding sweatshop labour conditions and not harming the working environment (as cited in Goworek, 2011).

The social issues related to the fashion industry can be connected to several social topics, such as (Rinaldi & Testa, 2013):

- *work and human rights*: this topic considers labour standards in workplace, employee's well-being and the respect of human rights;
- *governance and fair practices*: it encompasses the company's governance and the related practices of an ethical competition;
- *society and community*: it refers to the business impact on social and environmental systems of the local community within it operates;
- *product and consumer's responsibility*: it considers the health and the security of customers, the information available on labels, marketing activities and customer's privacy;
- *suppliers relationship*: it refers to the all the relationships between the firm and its suppliers along the value chain, like for example: compliance with the deadlines or application of a code of conduct.

Although ethical fashion considers all these elements, in the current framework, the topic about work conditions and human rights has become crucial within the relationship between fashion and society. This is due to the fact that the fashion industry is one of the largest employers worldwide, with more than 60 million workers (Global Fashion Agenda & The Boston Consulting Group, 2018). Most of these workers are coming from countries characterized by cheap labour force, inefficient governance and little trade union representation, which put at risk the respect of human rights (Environmental Audit Committee, 2019). For brands and retailers, avoiding sourcing from these countries is challenging, since a large part of their production is exported from these countries. However, the violation of human rights and the unsafe working conditions bring reputational risk for brands (Anner, 2018). To address these issues, brands are implementing corporate social responsibility practices at their supplier's factories and monitor them through audits.

2.4.1 The social cost deriving from the current fashion system

The current fashion system, besides the environmental cost, has also a significant social cost. The negative effects on society extend from workers to the local communities surrounding the factories. As 60% of manufacturing facilities are located in low-cost labour countries such as China, Bangladesh, Vietnam, India, etc. (World Trade Organization, 2019), many garment workers are still living in poverty, working in unsafe factories and facing poor working conditions (Global Fashion Agenda & The Boston Consulting Group, 2018). All these elements have been highlighted in 2013 by one of the largest industrial disasters, the Rana Plaza factory collapse in Bangladesh, which called attention to the opacity of the current fashion industry and to the unsafe working environments in most of the garment manufacturing countries (Environmental Audit Committee, 2019).

Local communities, while benefiting from employment in the industry, may also suffer from wastewater, release of substances of concern into biosphere, damage of local surroundings, pollution of local water source used for drinking and fishing (Ellen MacArthur Foundation, 2017). The hazardous substances used in the textile processing create dangerous working environment for the workers and affect their health and well-being. Besides the exposure to toxic working environments, there are other issues associated to poor working conditions and environments such as forced labour, sexual molestation, child labour, long-working hours, absent safety cautions, unsafe buildings and non-compliance with international working standards (Global Fashion Agenda & The Boston Consulting Group, 2018). Despite the presence of international standards and local laws that should protect people and their rights, human rights violation is a common issue in the fashion industry.

The 75% of global garment workers and artisans are women and girls (Richero & Ferrigno, 2016), which suffer discrimination and violation of their rights (Akhter, Rutherford, & Chu, 2019). The employment is, in fact, characterized by gender inequity and discrimination. This discrimination extends also to a gender pay gap. For instance, in Pakistan only 13% of women workers are paid the minimum wage compared to 73% of men (Chalmer et al. , 2018). However, the legal minimum wage in most garment-producing countries is not enough for workers subsistence. Low wages and unfair pay are forcing workers to work long overtime hours above the normal hours in unsafe conditions, in order to gain extra money and to achieve a minimum level of subsistence (Akhter et al., 2019; Crinis, 2019). Furthermore, the employment conditions are precarious with worker having temporary contracts. The right of freedom of association is violated, therefore individuals cannot rise their problems and have no the

possibility to negotiate their wages and working conditions (Environmental Audit Committee, 2019).

The poor wages paid to garment workers and long working hours are the result off the current competitive fashion industry. In an effort to keep the investments of the western brands, garment producing countries set a very low minimum wages, worrying that higher prices might move their investments in other more competitive countries (Woodside & Fine, 2019). Moreover, the pressure imposed by retailers on suppliers to manufacture products at lower price and with shortest lead times are worsening these problems (Anner, 2018; Crinis, 2019). Workers have to work longer and harder to meet the deadlines. Although the overtime should be paid according to the regulations, not all the factories meet this commitment (Akhter et al., 2019). Moreover, suppliers are more concentrated on meeting the fast-fashion deadlines and on not losing buyers, rather than in maintaining the safety of the buildings and in addressing the poor building standards (Crinis, 2019). In addition, new buildings or additional floors are built without permission in order to meet the increasing demands of retailers and brands.

2.4.2 Corporate social responsibility

The negative impact of fashion industry on society highlights the need for apparel manufacturers and brands to show more responsibility to their workers and society, by improving the labour standards and the commitment to reduce the social and environmental issues. In this context, corporate social responsibility (CSR) activity is becoming a concern in the globally dispersed supply chains (Rinaldi & Testa, 2013). According to Green Paper (2001), the CSR represents the voluntary integration of social and environmental issues of firms within their activities and in their relationship with stakeholders (as cited in Rinaldi & Testa, 2013). The World Business Council for Sustainable Development (WBCSD) (1999) states that CSR represents the commitment by business to perform ethically and to participate to the economic development through the improvement of the quality of life of the workforce and of the local community and society (as cited in Woo & Jin, 2016). However, these definitions lack clarity, leaving the execution of CSR open to individual interpretation of firms (James & Montgomery, 2017).

The CSR programmes may encompass a wide range of issues and dimensions. The Global Reporting Initiative[6] (GRI) (2011) provides six guidelines on which to base the CSR activities such as: human rights, labor, social, environmental, product responsibility and economic (as cited in Woo & Jin, 2016). For instance, the *human rights dimension* concerns a company's

[6] GRI is an international non-profit organization that offers CSR reporting services for brands and is approved by United Nations World Summit on Sustainable Development (Woo & Jin, 2016).

defense of basic human rights, such as nondiscrimination, freedom of association, antichild and antiforced labor. The *labor dimension* regards the company's compliance with labor laws and standards in workplaces, such as workers' health, safety, working hours and well-being. The *social dimension*, instead, is about corporate responsibilities to avoid negative business' impacts on the social system and to improve the local community's welfare; for example it could imply the use of local suppliers to encourage the local employment (Huq, Chowdhury, & Klassen, 2016). The *environmental dimension* regards issues related to the impact on natural ecosystems and environmental protection. The concerns related to products/services that directly influence customers health and safety relates to *product responsibility dimension*. Finally, the *economic dimension* focuses on the impact of business on the local and global economic conditions (Woo & Jin, 2016). Therefore, the CSR programmes include firm-specific policies, guidelines, codes of conduct and monitoring initiatives that helps to assess and address violations and discriminations.

By embracing CSR activities in a strategic way, fashion brands are more likely to obtain benefits in terms of reputation and risk management, employee recruitment and retention, operational efficiency, support from social and environmental activists, signaling better product quality, as well as offering benefits to the society at large (Perry & Towers, 2013; Crinis, 2019). However, the characteristics of the current fashion industry, the configuration of the apparel value chain and the institutional context may threaten the successful implementation of CSR (Perry & Towers, 2013; Anner, 2018). The pressure on lead times and low prices imposed by fashion brands on suppliers are vanishing the CSR efforts towards improving long working hours, low wages and working conditions. Moreover, the apparel value chain is very fragmented and complex with suppliers located in countries with great variation in government regulation and employment, hence it is becoming difficult for retailers to balance the loads of legal and social standards in order to effectively implement the CSR throughout the value chain (Perry & Towers, 2013). The research suggests that the institutional context and the regulatory mechanism of the countries in which the CSR programmes are applied influence its potential effectiveness (Brammer et al. 2012, as cited in Anner, 2018). For instance, strong state regulatory mechanism can enhance CSR programmes, whereas the effect of CSR tends to be hindered in low regulatory countries. While developed countries tend to have strict regulations and standards for the protection of workers' rights, in developing countries the regulation and standards are very poor and sometimes quite inexistent (Perry & Towers, 2013). Therefore, the implementation of CSR in these latter can be increasingly challenging. Poor CSR practices or

implementation can translate in bad reputation and loss of brand value, consumer boycotts and decrease in profitability (Perry & Towers, 2013).

2.4.3 Social practices in the fashion system

A responsible company has to defend the rights of their workers and to contribute to the development of their skills in every country their production is located, by extending their CSR practices to the whole value chain (Rinaldi & Testa, 2013).Promoting fair wages that meet the basic needs of the workers, can contribute to the well-being of the individuals employed along their value chain. Although brands and retailers are not establishing the wages of their indirect workers, they can obtain the institutional support of the local governments and collaborate with industry stakeholders to encourage the implementation of better wage systems (Chalmer et al., 2018). Brands can also reduce workers' poverty and long working hours by decreasing the pressure on suppliers for producing at lower prices and increased speed.

Brands and retailers should encourage the freedom of association and facilitate the collective bargaining of workers by collaborating with governments and multi-stakeholder associations. The access of workers to trade unions could enable significant progress towards living wages and working conditions for garment workers. Protecting workers' rights is not just about CSR, but it also could increase the productivity and the profitability of the brands (Woodside & Fine, 2019). By improving the working conditions, suppliers not only satisfy the basic human rights and the required standards, but also contribute to reduce the work absenteeism, turnover and to increase workers motivation. Implementing higher safety practices such as the installation of fire protection systems and the use of protective equipment such as safety shoes and masks, and healthier working environments at the factory are likely to decrease the number of work accidents and injuries, thereby reducing the man-days lost and costs (Global Fashion Agenda & The Boston Consulting Group, 2018). Moreover, by preventing accidents such as factory fires, building collapse, brands and retailers are secured against potential losses of human lives, future financial losses and reputational risk.

As the majority of garment manufacturing countries are developing countries where poverty is a major problem and with women lacking opportunity for education and independence (Akhter et al., 2019), retailers could implement strategies that address the gender inequality and women vulnerability and discrimination within the supply chain. Training programs directed towards improvement of skills to increase their efficiency and capacity, so that they can reduce the overtime work and can advance more rewarding positions in manufacturing floor (Akhter et

al., 2019). Managing the complex social issues requires actions at different levels: employers, brands and retailers have to implement effective systems that prevent abuse of workers' rights; governments should implement effective systems for workers' protection and support and workers should start to ask for the defense of their rights.

2.5 Approaches to sustainability implementation by fashion firms

Based on the environmnetal and social practices implemented by companies in the fashion industry, several strategic approaches to sustainability can be identified in the literature. Macchion et al. (2018) distinguish among reactive, proactive and value-seeker approaches, depending on internal and external sustainability practices. Whereas, the approaches identified by Schaltegger & Burritt (2014) based on a literature review are efficiency, consistency and sufficiency.

The *reactive approach* implies that the company implement low internal and external sustainability practices, thus it is investing minimal efforts towards sustainability implementation and simply complies with sustainability laws without committing more than is necessary. Indeed, the drivers that push for sustainability actions experienced by these companies are mainly related to external pressures deriving from existing and emerging regulations. Considering the limitations that hinder these companies to follow a more systematic approach are the the lack of internal resources to be allocated to the achievement of the sustainability goals and the lack of commitment by the top management to encourage sustainable actions within the company.The sustainability practices implemented by the reactive company are directed mostly towards the reduction of costs deriving from energy-saving solutions, periodical assessments and tests to verify whether the company is complying with the standards imposed by the regulations (Macchion , et al., 2018).

Conversely*, proactive* companies are following a more systematic approach to sustainability issues compared to reactive companies. They are not limited to regulations but seek to gain a competitive advantage by trying to go beyond legislations' compliance. Therefore, they implement higher internal sustainability practices and try to collborate and apply external sustainability practices within their network. A proactive approach implies that a company is striving to include sustainabiliy in its mission and overall strategy. Among the drivers of a proactive approach are the commitment from the top management and the willingness to improve the sustainability profile of the company (Macchion , et al., 2018).

The *value-seeker* companies are at the forefront of social and environmental sustainable practices; they are continuosly implementing sustainable practices internally and outside the borders of the company, extending within the entire supply chain. The company's practices and actions are the result of a high internal commitment which is extended to every level of the organization. For these companies, sustainability is seen as a winning factor in the market and they try to create a competitive advanatge based on sustainability. Indeed, the sustainability goals are the focal point of the companu's decisions and strategy. Through the concept of sustainability, they attempt to offer in the market value-added products compliant with the principles of environmental and social sustainability. Therefore, the synergy between sustainability and quality makes these companies highly innovative about how to address the sustainability issues.. Moreover, they are able to guarantee the traceability of their raw materials by establishing strong relationships with their suppliers and by sourcing mainly from local suppliers. Compared to the reactive and proactive companies, value-seeker companies are engaged in developing new production processes that can improve the working conditions and have less environmnetal impact in terms of chemical management, water and energy use, waste creation and consumption of natural resources.

The *efficienc*y approach relates to the principle of creating economic value while at the same time reducing the social and environmental impacts. However, focusing only on the efficinecy aspect, companies risk to miss opportunities to generate broader sustainability advantages (Etsy & Winston, 2009, as cited in Ho & Choi, 2012). The *consistency* approach entails the substitution of unsustainable materials with those consistent with nature. Unlike the efficiency approach which tries to reduce the material stream, the consistency approach aims at identifying alternative products and to replace the harmful ones. Finally, the *sufficiency* approach is related to the reduction of the amount of manufactured products. Therefore it is based on the idea of less consumption and the replace of products with services.

These approaches can be integrated within the strategy of the companies. A company usually starts its sustainable path through reactive and efficiency approaches, passing through strategic proactivity and consistency in order to achieve the final phase and becoming a value seeker company.

2.6 Technology as an enbaler for sustainable fashion

Technology and sustainable fashion might appear to be unrelated, however the literature and the practice show that the there is a close relationship between the two areas (Scaturro, 2008).

Therefore, there is a synergy between technology, sustainability and fashion, starting from production and ending with the end-of-use of fashion product. In the literature there is a debate on the role of technology, whether as a positive or a negative factor, for fashion sustainability. Sometimes, technology is seen with negative lens as a driver for overconsumption and commoditization of the fashion products, hence creating the current unsustainable fashion system. Indeed, as a result of the improvements in networked technological systems, the fast fashion phenomenon has risen which creates cheap clothing with harmful environmental and societal methods. Therefore, based on this belief, technology is in part considered guilty for the current environmental and social repercussions of the fashion system.

The other belief outlines the positive role of technology in achieving a suatainable fashion system. Indeed, technology when selectively developed and applied is seen as a crucial enabler and facilitator that allows the implementation of sustainability in the fashion sector. It can satisfy the sustainable requirements of the market and society, allowing sustainable methods of material and clothing manufacturing, consumption and disposal (Scaturro, 2008). In this context, Scaturro (2008) suggests the "Eco-tech Fashion" concept, which represents the idea of the development of a sustainable fashion system and the encouragement of social and ecologic practices through innovative technologies.
In this context, the technological mediation of sustainable practices can be divided into *material* and *digital*. The term material relates to the physical creation of sustainable fashion considering the design options, fiber production and sourcing decision, recycling and recovery. The digital expression represents the impact of the internet and Information and Communication Technologies (ICT) on sustainable fashion through the communication and information spreading of conscious production and consumption (Scaturro, 2008).

The material category, implies smarter manufacturing and production techniques, which sometimes derive from conventional technology and are improved and adjusted to the current sustainable needs and goals. The damage of the industry including harmful chemicals, textile waste, unsafe working environmnets can be limited through the implementation of innovative technologies. Indeed, the creation of more sustainable fibers and textiles require the use of significant innovative technologies and techniques. For instance, sustainable fibers such as lyocell, bamboo derive from renewable and compostable biological sources, however their creation requires high amount of chemicals and energy. Thus, in order to make these fibers trully sustainable, technology have to be implemented to manage the chemicals and to limit the energy consumption (Scaturro, 2008). Technologies such as waterless dyeing, 3D printing, no

stone washing have the potential to move the fashion system towards a more sustainable one (Payne, 2019). Furthermore, innovation in recycling technologies are becoming increasingly important in the current context and for the adoption of the cradle-to-cradle principles necessary to reduce the waste deriving from the fashion industry. Similarly, technological improvements in garment machinery can potentially provide workers with safer and cleaner workplaces. Moreover, the monitoring and traceability obtained through the new technologies can further ensure worker's rights protection.

The digital realm of technology, enables the transparency of the value chain, providing in this way consumers with the ability to see where their clothing is manufactured and by whom, and to solicit companies on following unethical practices. Unlike the material realm, these technologies are not used by the fashion value chain as a material intervention in the manufacturing of fashion products, rather it creates a relationship between consumers and manufacturers, promoting more sustainable production and consumption (Payne, 2019). By wisely exploiting both the material and digital aspects of technology it is possible to achieve an ethical and sustainable fashion system.

Focusing on industry 4.0 technologies, there are several technologies which are changing the fashion industry and the production processes. Some of them are well established such as laser cutting and linear digital printing, RFID, 3D printing, virtual reality etc., others are still in the beginning phase such as blockchain, additive manufacturing, virtual prototyping (Bertola & Teunissen, 2018). The availability of these technologies are creating a more integrated value chain, resulting in reduction of inefficiencies and negative impacts of fashion production. Overall the fashion industry seems to be willing to incorporate the industry 4.0 technologies in its processes, but according Bertola & Teunissen (2018) there is a lack of an integrated digital infrastructure and the lack of awareness of the future skills of the human resources needed by the evolving fashion industry. This implies that the companies are not able to integrate, objects, machines and people which allows a real-time control. Moreover the high costs related to technology, and structure reorganization are preventing the companies from systematically approaching their transition to industry 4.0 technologies (Bertola & Teunissen, 2018).

CHAPTER 3 – SUSTAINABLE FASHION SUPPLY CHAIN MANAGEMENT: GOVERNANCE AND TRACEABILITY

Introduction

The apparel value chain is very fragmented and complex, with manufacturers and suppliers often located in different parts of the world, specialized in different operations and following distinct regulations set by local institutions (Kumar et al., 2017b). As stated in the first chapter, the majority of fashion brands and retailers do not own their manufacturing facilities, thus they lack visibility and control about where and in which conditions their products are manufactured (Ditty et al., 2019b), and few of them know the origin of the components of a garment such as buttons, zippers, threads and even fabrics (Ditty et al., 2019). Across the industry could happen that a brand contracts a supplier, and then the latter in turn subcontracts the work to other facilities, if for example it needs a special process to be done such as dyeing, embroidery, or other finishing activities, or if it needs to meet a short deadline (Ditty et al., 2019b). The unauthorized subcontracting, indeed, presents the highest risk of human rights violations and negative environmental impact, since their activity and workers tend to be invisible in the eyes of brands (Baptist World Aid Australia, 2019). Given that brands do not employ directly workers in garment factories and do not own the factories they produce in, they can pass the responsibility for the factory disasters, poor working conditions, environmental issues and violation of human rights to their suppliers, while being free of accountability (Environmental Audit Committee, 2019). Therefore, fragmented and opaque value chains make it extremely challenging for lead buyers to manage the supply chian, to know the name of their suppliers and the history of their products, identify exactly where the risks lie and to respond to the growing demand from consumers and NGOs for sustainable production practices and transparency in the fashion industry.

Therefore, higher visibility, monitoring, transparency and traceability of the supply chain actors and information about their processes and working environment is required, in order to achieve a more sustainable fashion supply chain management, to make brands more accountable for their operations and to make suppliers and manufacturers more visible.

3.1 Sustainable Supply Chain Management

The supply chain consists of all the activities related to the transformation of the products from raw material phase up to the end user and the associated flows of material, information and capital (Suering & Müller, 2008). Supply chain management (SCM) aims at integrating all the activities and the actors part of the supply to achieve a sustainable competitive advantage.

Nowadays, given the increasing demand for environmental and social sustainability, the SCM is becoming a sustainable supply chain management (SSCM) approach. SSCM is defined as the management of companies and the material, information and capital flows along the value chain, while guaranteeing the achivement of the three dimentions of sustainable developemt - environmnetal, social and economic (Suering & Müller, 2008; Garcia-Torres etal., 2019). This definition is quite broad and incorporates the sustainability definition into that of SCM.

Since brands are operating in a highly dispersive and complex value chain, in order to be competitive, transparent and to respond in a timely way to the changing demands and sustainability issues, SSCM has become crucial for them. SSCM can be achived in several ways; through formal governance mechanisms such as codes of conduct, industry standards and regulation, certifications, audits and monitoring (Garcia-Torres et al., 2019). Another way to achieve SSCM is through close relationship and collaboration with the supply chain actors to implement common goals. Collaboration can be established between brands or lead firms and their suppliers or between value chain players and external stakeholders such as NGOs, industry institutions and multi-stakeholder collaborations. The third way to achieve SSCM is through traceability and transparency of the value chain. In particular, the ability of the companies to trace their products, processes and impacts reduces the information asymmetry among the actors and the possible opportunitic behaviour of suppliers (Causins, Lawson, Petersen, & Fugate, 2019). The ability to track and trace products from the origin until the consumption supports firm abilities to recognize and address specifc risks emerging within the supply chain.

Technology (RFID, blockchain, smart software, ICT) and management systems (for example: Social accountability 8000, Enterprise resource planning) are enabling and facilitating the sustainable management of the supply chain, by fostering transparency and traceability, sharing information and knowledge between value chain actors (Suering & Müller, 2008).
Moreover, the literature highlights several challenges that can hinder the SSCM: cultural differences, lack of shared values and goals, the absence of globally acepted standards and audit-related issues.

3.1.1 Governance mechanisms for sustainable supply chain management

3.1.1.1 Code of conduct and its implementation

Operating in a complex supply chain with suppliers located in several countries with different regulation and cultures, makes difficult for brands to ensure that CSR practices and standards are followed by all suppliers at different levels of the value chain (Perry & Towers, 2013). As

a result, a code of conduct is drafted and established at factories in order to require compliance to responsible standards and principals, especially when suppliers are located in countries with poor regulation. According to the Organization for Economic Co-operation and Development (OECD, 2001), the code of conduct represents a voluntary commitment made by the companies or other entities which contains standards and principles for the conduct of the business in the marketplace (as cited in Jaiswal & Ha-Brookshire, 2019). It may contain guidelines, private rules and reccomendations that aim to drive the corporate behavior towards a responsible business (Jaiswal & Ha-Brookshire, 2019; Perry & Towers, 2013). Most of the times, suppliers have to sign the code of conduct before entering the business relationship.

The codes of conduct include the worker's rights which suppliers are expected to respect and improve, and their standards and practices usually refer to some of the International Labour Organization's (ILO) Fundamental principles and rights at work which include the abolition of child labour and forced labour, prohibition of employment discrimination and excessive overtime, and assurance of fair living wages, safe working environment and worker rights to freedom of association and collective bargaining (Egels-Zandén & Lindholm, 2015; Crinis, 2019).

For an effective CSR standards implementation and enforcement is necessary to apply the code of conduct to the whole supply chain, and not only to the first-tier suppliers, including the lower levels and less visible sections such as raw material production and textile processing which have an increasing negative social performance. The upstream levels of the supply chain are, in fact, at greatest risk of rights' violation, since many companies end to apply their codes just to their final stage manufacturers (Baptist World Aid Australia, 2019). Although the first-tier suppliers are directly influenced by the introduction of a code of conduct, even in first-tier factories is difficult to enforce the respect of workers' rights. Most of the times, the first-tier suppliers employ other suppliers or subcontractors for dyeing, embroidery and other finishing processes and they are usually not monitored (Crinis, 2019). Therefore, there is the need to apply the code of conduct to the entire value chain and to monitor the respect of its standards and guidelines.

Nevertheless, the code of conduct can be interpreted in different ways which result in different approaches to its implementation. Jaiswal & Ha-Brookshire (2019) state that most of the times, the codes of conduct are not interpreted as a voluntary tool to improve standards, but is rather seen as a merely tool to attract new buyers and to increase sales, ensuring buyers about their product quality. Due to this perception, suppliers may comply only to mandatory standards

required by brands or by the local governments, with the only aim to attract new buyers and increase their sales rather than supporting the goals of code of conduct. Whereas, other manufacturers can interpret it as guidelines that help to improve the labour practices, which in turn translates into longer worker's retention, higher quality and increased production rate (Jaiswal & Ha-Brookshire, 2019). In this case the aim of the implementation of the codes of conduct goes beyond the need to secure orders, and meet the original goal of the code of conduct which is to offer better working conditions that increase worker satisfaction, productivity and retention. In achieving this, suppliers are engaged and collaborate with different stakeholders, including workers and buyers, which results in closer relationships among them and increased transparency of their working standards and higher probability of the compliance to the code of conduct's practices (Jaiswal & Ha-Brookshire, 2019).

However, some reasearches have criticised the effectiveness of codes of conduct to guide socially responsible principles in supply chain and to translate into improvement at suppliers' factories (Jaiswal & Ha-Brookshire, 2019; Egels-Zandén & Lindholm, 2015; Crinis, 2019). Hofstede & Hofstede (2005) claim that since the codes of conduct contain Western social standards, for suppliers located in emerging countries could be a challenge to incorporate these standards into their operations (as cited in Jaiswal & Ha-Brookshire, 2019). This implies that the code of conduct's intentions may not be understood in the same way by suppliers located in different countries than those of brands and retailers. Therefore, the codes of conduct should take into account the cultural and social conditions of the supplier countries, in order to be more efficient. Moreover, research shows that codes may improve just some workers' rights but not all of them. They are more likely to improve the outcome standards such as health, safety and working hours and wages, while they fail to improve the process rights such as discrimination and right of association in trade unions (Egels-Zandén & Lindholm, 2015). A paradox that undermine the code of conduct effectiveness is that companies use code of conducts to create a good ethical image, and to improve the performance and the standards at their manufacturers' factories, but at the same time they continue to put pressure on purchasing prices and lead times to increase their profits rather than focusing in improving worker's rights, thereby weakening the effects of the codes of conducts and audits (Egels-Zandén & Lindholm, 2015; Crinis, 2019).

Buyers can motivate the compliance to the codes of conduct or standards by introducing compliance as the necessary requirement for securing orders (Huq et al., 2016). In addition, the code of conduct are more likely to be enforced through auditing initiatives that check the supplier compliance with the code.

3.1.1.2 Brand Audits

The social auditing process consists in assessing and monitoring the supplier's performance and compliance to the corporate codes of conduct or third-party certification, thereby measuring, tracking and enhancing standards in their supply chain (LeBaron, Lister, & Dauvergne, 2017). The auditing activity gives retailers and brands the opportunity to monitor their suppliers in a decentralized system of production, where there is an increasing pressure for more transparency and accountability. Historically, audits have been used for internal management of the larger business with the aim to reduce the public relations risks. However, in the last decades the role of auditing switched from internal business management to the sustainable supply chain management, due to the growth of offshore manufacturing in emerging economies and with the increasing concerns about supplier performance. Thus, brand auditing programs are used as a tool to improve factory conditions and environmental issues worldwide and are legitimated by governments (LeBaron et al., 2017). Indeed, the code of conduct implementation may be enforced through auditing activities and transparency (Huq et al., 2016; Jaiswal & Ha-Brookshire, 2019). Furthermore, brand auditing can be also seen as a tool to increase the brand value, as well as the corporate transparency and accountability. The audits typically entail the review of the supplier's labour practices and standards, including working hours and labour contracts and the examination of working conditions comprising health and safety issues (Huq et al., 2016). Suppliers have to prove the compliance with specific guidelines contained in brands' codes of conduct or certifications regarding the child and forced labour, equal opportunities, safety, working hours and remuneration, and freedom of association and collective bargaining right.

There are different types of audits a brand or retailer can employ. Whether the retailer or brand owns internal qualified staff that has the skills to conduct the audits, an internal buyer audit can be applied (Huq et al., 2016). Otherwise, brands can subcontract the audits to a third-party which arranges the audit on behalf of the brand or retailer and prepares a report. The third-party audits are considered more transparent and competent than internal audits. Another type is a third-party audit undertaken on behalf of suppliers, often used to demonstrate compliance to a standards or certification, thereby attract and retain buyers (Huq et al., 2016).

The literature highlits the difficulty to assess the effectiveness and the effects of the audit processes, as it relyes on retailer's capabilities and intentions. The effectiveness of a brand auditing could depend on the collaboration capabilities of brands with their suppliers and their intention to jointly improve the social standards and outcomes (Huq et al., 2016). LeBaron et

al. (2017) claim that retailers and brands use audit programs in a way that legitimate and protect their business interests, rather than addressing social and environmental problems within their value chain. In this way, they create the illusion of an effective value chain governance, and keep the current business model based on low prices and short lead times.

In some cases, the audit activities may result to be ineffective. In particular, this may happen when auditors are inspecting areas that suppliers decide to show them and when audits are announced, thereby suppliers are prepared and workers are instructed on what they need to say. In this case, the audit is not presenting the real situation at the supplier's factory. The ineffectiveness of audit programs is more often present when these are conducted by auditors which do not interview workers and labor union representatives, but rely just on data provided by the owners or managers (Egels-Zandén & Lindholm, 2015). In some cases suppliers are keeping duplicate records and reports, for example with regard to worker's pay, a real record to establish the effective worker pay and the falsified one that hide the reality to be shown to auditors (Huq et al., 2016). Therefore, the audit programs are not able to detect and correct all the labour and environmental problems. And though audits are able to detect the social issues, there is also no guarantee that brands will adress them. Due to the fear of losing business, brands tend sometimes to conceal the problems identified (LeBaron et al., 2017). Moreover, many fashion retailers and brands are auditing only their first-tier suppliers and expect these suppliers to audit their sub-contracted suppliers down the chain. However, most of these first-tier suppliers are not conducting any audit of their suppliers (LeBaron et al., 2017). Furthermore, since suppliers conduct business with multiple buyers, they are subject to different forms of audits and standards and this could create difficulties and confusion in complying with all these standards, thus resulting in ineffective or superficial compliance (Huq et al., 2016).

3.1.1.3 Standards and certifications

Firms signal their sustainability through being a member in a famous sustainable association or initiative or by disclosing their certifications, in this way reducing the information asymmetry along the value chain (Watts, 2015). Brands and manufacturers could use these certification to support their sourcing decisions and to create transparency on the inputs used in and the impacts created by their operations across the entire supply chain. According to Richero & Ferrigno (2016), voluntary standards and certifications may set an approach to traceability. Jahn et al. (2005) state that a certification represents a mandatory or voluntary assessment and approbation by an authorized party on an specific standard (as cited in Poncibò, 2007). Under a certification process, products are evaluated and validated as conforming to applicable standards. According

to Poncibò (2007), certifications consist of two elements: certifying the firm when it performs accordingly to the standard; and certifying the product by tracing it and ensuring it comes from a certified source.

The certification process consists of some key specific steps, which are (Poncibò, 2007):

- *Establishment of the standards*: certifications are based on agreed and clear standards that are set by NGOs, Government, trade association or developed internally by firms such as code of conduct;
- *Conformity assessment for compliance*: the assessment is performed usually by third party audits that evaluate the compliance with the standards;
- *Certification label*: after the certification assessment, a certification label is attached to a firm or a product, thereby stakeholders can identify that specific firm or product as certified;
- *Accreditation*: the certification body guarantees that certifiers (the entity that undertook the certification) are competent to do so;
- *Compliance monitoring*: the certified entities and products have to be continuously monitored to guarantee their compliance with the established standards over time, as well as the certifying organization have to be controlled to ensure that they are applying correctly the standards.

There are multiple voluntary standards, certifications, guidelines and multi-stakeholder initiatives which cover various issues and phases of the value chain, many of these containing elements that address the traceability implementation in the fashion industry (Richero & Ferrigno, 2016). The current section will present just some of them.

The **Global Organic Textile Standard (GOTS)** is considered the world's leading processing standard for textiles made from organic fibres. It establishes high-level environmental standards along the entire organic textiles supply chain and requires compliance with social principles as well (GOTS, 2019). Some initiatives are focused just on a single issue, such as **Standard 100** by **Oeko-Tex** which certifies against harmful substances. Others are focusing either on a type of material and a type of production or certify only a specific phase of the value chain (Richero & Ferrigno, 2016). Larger initiatives include the **ZDHC**[7] Foundation and its Roadmap to Zero Programme which aims at implementing best practices in sustainable chemicals management to guarantee lower environmental footprint and safer working environments (Global Fashion

[7] Zero Discharge of Hazardous Chemicals

Agenda & The Boston Consulting Group, 2018). The benefits of these initiatives are to provide transparency of the chemicals used in production and detailed restricted substances lists (MRSL). Tools such as **Sustainable Apparel Coalition's Higg Index**, instead, enables brands and retailers to measure the product' sustainability performance at every phase of the value chain (Sustainable Apparel Coalition, n.d.). The Higg Index allows and encourages brands, retailers, and manufacturers to become transparent by disclosing clear, comparable, and meaningful sustainability scores publicly. In addition, the Sustainable Apparel Coalition are providing toolkits with guidelines that support the members to become more transparent. (Sustainable Apparel Coalition, n.d.).

Sometimes, firms can establish their own guidelines and standards to be applied at their supplier's factories, in order to fulfill their expectation for origin of raw materials, traceability and certification of inputs. For instance, in 2018 Kering published a set of sustainability standards for manufacturing process and raw material sourcing to be used by all their suppliers and sub-contractors. By defining these detailed standards, Kering is able to reduce the environmental and social loads created by their brands, to trace their key raw materials and to enhance the transparency across all materials used (Global Fashion Agenda & The Boston Consulting Group, 2018).

3.2 Value chain traceability and transparency

3.2.1 Definitions

As the value chain encompasses several players, sustainability cannot be achieved by the efforts of a single one, rather than in a collaborative way that involves all the actors by tracing and integrating the information of the entire value chain (Kumar, Agrawal, Wang, & Chen, 2017). Value chain traceability and transparency are key mechanisms to promote sustainable management of global supply chains (Garcia-Torres et al., 2019). Not knowing who are producing and sourcing the products, make it challeging for brands to monitor and control their suppliers and the social and environmental issues across the value chain.

Most of the times, "*transparency*" and "*traceability*" are used as the same terms. However, there are some differences among them. According to Ditty et al. (2019*b*), transparency represents the "*credible, comprehensive and comparable public disclosure of data and information about fashion's supply chains, business practices and the impacts of these practices on workers, communities and environment*" (p. 16). It is presented either as a key element of CSR and SSCM or as a means to add visibility to the supply chain by telling who

are the players that are participating in the manufacture of clothes along the entire value chain (James & Montgomery, 2017). Transparency does not imply just sharing good practices and stories nor discolsing only compliant suppliers, it means presenting the full picture of the value chain, both with good and less good information (Ditty et al., 2019b).

While *transparency* represents the disclosure of information about suppliers and the sustainability conditions at suppliers factories, *traceability* implies the identification of supplier's names, the address of their facilities and the types of products/services made at each supplier facility (Egels-Zandén et al., 2015). Therefore, Kumar et al. (2017b) state that traceability brings more transparency across the value chain by systematically managing the information associated with the product. "A Guide to Traceability" by United Nations Global Compact (2014) extended the definition of traceability established by the International Organization for Standardization (ISO) and added also a sustainability component, thus defining traceability as "*the ability to identify and trace the history, distribution, location and application of products, parts and materials, to ensure the reliability of sustainability claims, in the areas of human rights, labour (including health and safety), the environment and anti-corruption*" (p.6). Traceability is composed from two aspects: *tracing* which represents the ability to determine the origin of the product, and *tracking* which is the ability to follow the path of a product along the supply chain (Macchion, Furlan, & Vinelli, 2017). Moreover, two different levels of traceability exist: internal traceability which occurs within firm's boundaries, and network traceability which represents the ability to track and trace products along the entire network of suppliers, from raw materials to final product (Macchion, Furlan, & Vinelli, 2017).

3.2.2 The relevance of value chain traceability for SSCM

Value chain traceability facilitates an effective information flow among the supply chain partners, hence being important in managing the value chain actors and activities, creating visibility and transparency, quality and logistics management, and in addressing sustainability issues.

Traceability is a manifold concept which can be used and interepreted in different ways. In general, it can be used in supply chain management as a tool to gain access to information related to all supply chain actors and activities and to reduce the value chain risks, by using information technologies (IT), traceability tags and blockchain systems, thereby proving the origin of a product and its quality and improving the supply chain visibility (Kumar, 2017). In this way, products can be tracked and delivered on time, having an appropriate control of the inventory (Agrawal, Koehl, & Campagne, 2018). Moreover, it could allow brands to have a better management, control and understanding of their supply chain, hence, to integrate in some

way their complex chain of activities. Value chain traceability can be also used as a mean for brands to promote sustainability goals and to investigate and assess the sustainability issues along the whole value chain, through the collection of information from suppliers (Marconi, Marilungo, Papetti, & Germani, 2017). Nevertheless, the two concepts of traceability complement each other, as they are in some way interconnected. Tracing the location of suppliers and knowing who they are, represents the first step for a brand in taking the management of a more sustainable value chain (Baptist World Aid Australia, 2019). If tbrands do not know who are their suppliers, it is impossible for them to monitor whether the code of conduct' standards or other sustainable practices are respected or not and what are the environmental and social impact resulting from their activities.

Therefore, within the context of SSCM, supply chain traceability could be used as a mechanism to support brands to trace the most important sustainability concerns among the partners of a value chain, such as carbon footprint, water and energy consumption, and social risks during the product life cycle, allowing brands to take actions that can improve the sustainability issues (Marconi et al., 2017). In this framework, a life cycle assessment (LCA) tool can be used in order to collect all the potential environmental impacts across a product life-cycle. Moreover, traceability contributes to the control of the product related sustainability claims and to the collaboration with the various supply chain partners and stakeholders with the aim to facilitate the exchange of information related to a product and to achieve sustainability goals (Kumar et al., 2017; Chalmer et al., 2018). It is considered crucial not only for the processing phases, but also in the use and end-of-use phases, by overcoming the challenges connected to circular supply chain (Kumar et al., 2017). Having correct information about all the components of a garment, would facilitate the recycling activity, as garments are sorted on the basis of the type of materials. Moreover, the UN acknowledges the role of supply chain traceability in reaching the SDG goals, in particular those associated with sustainable economic growth and decent work (SDG 8), sustainable infrastructures and innovation (SDG 9) and sustainable consumption and production models (SDG 12) (UN General Assembly, 2015, as cited in Garcia-Torres et al., 2019).

Textile and fashion products are often subject to product recalls[8], due to the inability to control the suppliers and the use of hazardous chemicals, which, in turn, can damage the brand value (Kumar, 2017). An effective traceability system can be used in monitoring the quality of the

[8] Product recall is a process of withdrawing products from the markets due to safety or quality issues resulting from their noncompliance with the government regulations (Kumar, 2017).

products and in dealing efficiently with the execution of the product recalls, since it provides the possibility to access precise data about the origin of the products and to identify the issue that have led to recall, enabling the rapid intervention to address the problem (Kumar et al., 2017b). Moreover, the fashion products, especially belonging to high-end fashion are often predisposed to counterfeiting. By tracing their products, brands may improve supply chain control and security, thus preventing the counterfeiting of products and demonstrating product authenticity (Agrawal et al., 2018). At the same time, value chain traceability can act as a marketing tool for brands, which can stimulate the consumer confidence and assurance in the brands and products they buy, thus making more informed buying decisions (Kumar, 2017; Agrawal et al., 2018). Most of the times, the conventional labels contain just the country where the garments were manufactured, but it does not contain information about the source of the raw materials. Therefore, by tracing all the actors involved in the supply chain, brands can obtain a competitive advantage, thus building trust and attracting consumers to buy their products (James & Montgomery, 2017).

However, the implementation of traceability requires the active involvement and collaboration of all the partners of the value chain, willing to share their internal information with others (Marconi et al., 2017). Information sharing is, in fact, an important requirement for traceability and SSCM implementation (Kumar, 2017). Therefore, they could be enhanced through long-term supplier relationships and good supplier communication, and by having fewer suppliers (Egels-Zandén et al., 2015; United Nations Global Compact, 2014).

In addition, traceability is a technology driven concept, which depend on the adoption of proper technologies and maintenance of the system by each node of the supply chain (Kumar, Hallqvist, & Ekwall, 2017). In order to ensure traceability of the value chain, brands should establish a system that tracks all the products, parts and materials from suppliers, manufacturers and provides information on the components and their processing across the value chain, which ensures the garment's quality, safety and labeling (Agrawal et al., 2018). The track and trace systems rely mostly on tagging each product with a unique identifier such as RFIDs, QR code or barcode and using them as a tracing element (Agrawal et al., 2018) or, more recently, on using blockchain systems (Kumar et al., 2017). Furthermore, it is critical that whenever the actors of the value chain exchange the products, they have to provide also the product-related information along with the product (Kumar, 2017). This may help suppliers to shift from being just a contractor or subcontractor to being an important partner.

3.2.2.1 Life Cycle Assessment (LCA)

The Life Cycle Assessment (LCA) represents an approach aiming at identifying and assessing potential overall environmental impacts of any product or process, by using a systematic set of procedures and standards, thus enabling the traceability of data (Moazzem et al., 2018). It is also a standardized environmental assessment tool, defined according to the standard ISO 14044. Therefore, it helps to trace, quantify and compare the environmental impacts across all the stages of the life cycle of a product or process. The life cycle of a garment starts with the raw material extraction and processing, it passes through garment manufacturing, distribution and finally use and end-of-use which includes recycling or disposal activities (Moazzem et al., 2018). In general LCA is related to environmental issues, however it can be extended, in addition to environmental impact, also to social aspects resulting in a "Social life cycle assessment" (SLCA), to assess the potential positive and negative social impacts along the whole life cycle of a product (Roos, Zamani, Sandin, Peters, & Svanström, 2016).

For its functioning, LCA has to trace and monitor data deriving from every phase of the manufacturing processes, and after the assessment, the data should be interpreted to identify those stages of the life cycle where brands can reduce their environmental impact and to enhance the transparency (ISO, 2006). It can reflect the view of the extended brands responsibility by considering the environmental impacts created by each stage of the product's life cycle. It is also a useful tool in avoiding the transfer of a problem from one phase to another (Curran, 2013).

ISO (2006) provides a general framework for managing an assessment consisting of four phases in LCA study: goal and scope definition; inventory analysis; impact assessment and interpretation.

- The *goal and scope definition* represents the reasons of the study and the intended application. Clearly defining the scope implies also the establishment of the system boundaries to be assessed and it can include cradle-to-grave system (from raw material extraction to end-of-use and disposal), gate-to-gate (intermediate process phases), and cradle to gate (raw material extraction to intermediate processes).
- The life cycle *inventory analysis* involves the collection of input data such as resources and output data such as emissions and consumption of water and energy, necessary to meet the goals established. In this phase, resource's consumption have to be recorded for every stage of the value chain.
- The *life cycle assessment* phase evaluates the collected data to understand the significance of the potential environmental impact.

- In the *interpretation* phase, the results from previous phases are summarized and discussed and recommendations are provided in an effort to reduce the environmental impact.

For instance the Reformation brand developed the RefScale tool based on the LCA methodology. By using RefScale, the brand is able to quantify the environmental footprint of its collection, comparing it to industry standards and disclosing the resources saved on the company's website, displaying in this way the true cost of the product to the customers (Global Fashion Agenda & The Boston Consulting Group, 2018).

However, the LCA is used more in academic literature than in a practical framework of the fashion industry. This is due to the availability of a variety of products, many complex supply chain links and limited availability of inventory data for all the materials used in the manufacturing of fashion products (Kozlowski, Bardecki, & Searcy, 2012; Curran, 2013). Although ISO defines LCA and provides a general framework for its study, it leaves much to interpretation, thus it may lead to different results for the same product and process (Curran, 2013).

3.2.3 Achieving value chain transparency for SSCM

Transparency is an increasingly important element in the management of sustainability in the fashion value chain. Brands should be transparent about the practices they use to assess their suppliers, the results of these assessments and their efforts to address the identified issues within the value chain (Ditty et al., 2019b). The disclosure of this information allows NGOs to check the sustainability conditions at the suppliers' factories and to control the accuracy of the disclosed practices (Egels-Zandén et al., 2015). Transparency allows, in fact, to assess if the brand's and retailer's communicated responsible strategies are in line with their actions. For instance, to verify if the strategy that aims at improving the living wage actually results in better wages for workers. Therefore, it represents a way to check the effect of CSR policies, codes of conduct and standards, and the results achieved.

If a brand is not transparent, it is quite impossible for their stakeholders to know how a brand or retailer struggles to solve the issues of its supply chain. Furthermore, it is unimaginable for brands to ensure the respect of human rights and environmental practices, without knowing where their garments are manufactured.

Tranparency on inputs used for creating a garment, on production history and on care information such as recycling options are extremely important to inform about the actions to be taken. For instance, brands that are fully transparent on the inputs used in their clothing, could

more rapidly remove the use of hazardous chemicals in their supply chain (Ellen MacArthur Foundation, 2017). Likewise, knowing the composition of all materials and components used in a garment, could help conusmers to recycle it in a correct way. Moreover, it can also help consumers to take more informed decisions while purchasing a garment, by increasing their trust in transparent companies. By being transparent, brands are becoming more credible in the eyes of consumers, thus it can help to reduce the public pressure on company and enhance the brand value (Chalmer et al., 2018).

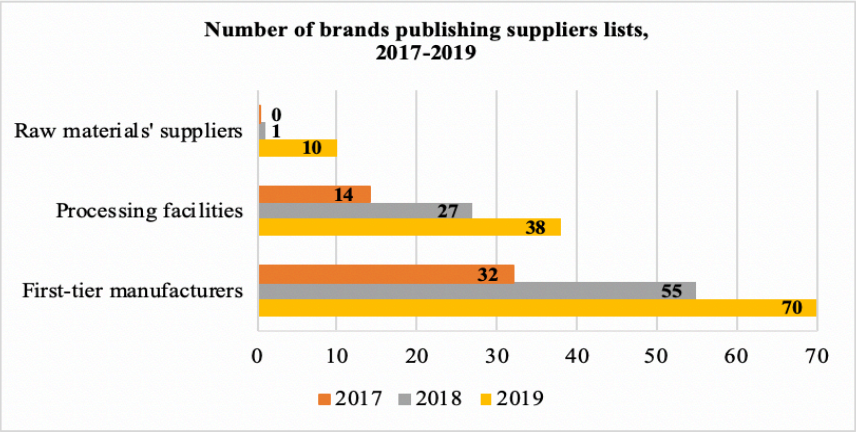
Transparency is also important for garment workers to understand what brands are doing to respect their rights and to improve their status. It could provide opportunity to improve the working conditions and worker's rights at the supplier factories through a collaboration with trade unions and multi-stakeholder associations to identify and address the issues faster, if relevant information is available (Ditty et al., 2019b). Moreover, workers can use the published information to negotiate for better wages and working conditions. Transparency can also motivate other brands to follow this path by discovering sustainable best practice examples in the supply chain and by learning good practices from those brands that are transparent (Ditty et al., 2019b). However, organizational transparency is not the same as organizational sustainability; value chain transparency represents the means through which sustainability policies and commitments are disclosed (Watts, 2015). For instance, a firm can adopt sustainable practices and act in a sustainable way while remaining quite opaque. Likewise, a brand may pubblish a high amount of information and data about their policies and impcats and still having poor working conditions and creating negative environmental footprint (Ditty et al., 2019b).

Even if there are some brands that disclose the names of their suppliers and a wide range of information about their social and environmental practices, commitments and impacts, there are still many brands falling behind (Ditty et al., 2019b).The highest scoring brands according to the Fashion Transparent Index 2019 are Adidas, Patagonia, Esprit, H&M and C&A. While brands such as Tom Ford, Mexx, Max Mara and others are not transparent at all.

Indeed, the Fashion Transparent Index 2019 reveals the poor state of transparency in the fashion industry (*Figure 11*); with 70 brands (35%) of the total 200 researched brands are publishing their immediate first-tier supplier, 38 brands (19%) are publishing their processing suppliers and only 10 brands (5%) are publishing some of their raw material suppliers (Ditty et al., 2019b). Esprit and Patagonia are the two highest scoring brands for transparency. Although

compared to the last two years, the number of brands publishing their supplier lists increased (*Figure 11*), there are still many brands that do not disclose any information about their suppliers.

Figure 11: Number of brands publishing suppliers list, 2017-2019



source: author's adaption from (Ditty et al., 2019b)

3.2.3.1 Communicating sustainability

The growing interest in sustainability issues and the pressure on brands for more sustainable actions, transparency and accountability, has driven brands to communicate their commitment to sustainability issues of their operations and supply chain. The increased access to information and the speed with which stakeholders can investigate firm's actions due to the spread of the Internet and electronic devices, have led to the empowerment of stakeholders and to increasing scrutiny of brands (McKinsey & Company, 2018). Therefore, it becomes crucial for firms to become more transparent and to communicate their sustainability impacts and actions in order to manage their brand reputation.

Sustainability communication refers to all types of corporate and marketing communication practices about issues related to environmental protection and social responsibility in relation to the economic achievement, having the aim to support and improve the corporate image in the eyes of its stakeholders (e.g. customers, investors, suppliers, workers, Government, NGOs, etc.) (Siano, Conte, Amabile, Vollero & Piciocchi, 2016; Da Giau, et al., 2016). Thus, brands often communicate the adopted social and environmental practices along the supply chain, their actions and the consistency between the initiatives supported and the claims.

The digital tools are playing an important role in the sustainability communication of brands, both to disclose information and to engage their stakeholders. Corporate websites are the

prevailing communication tools for disclosure of information regarding sustainability initiatives and are replacing the traditional communication channels such as newspaper, television, magazines, printed reports or brochure. (Da Giau, et al., 2016). One of the main advantage of adopting web-based communication is that it allows brands to directly publish a great amount of information in a rapid and inexpensive manner and to make information directly and immediately available to a wide and diverse public, as well as to continuously and timely update and personalize the information to different stakeholders (Moreno & Capriotti, 2009; Lodhia, 2014; Da Giau, et al., 2016; Siano, et al., 2016). Furthermore, in a digital context, the communication is becoming more interactive and engaging. Other features provided by web are the possibility to add multimedia information, hyperlinks, animations and portals for disclosing the sustainability information in a more effective way (Lodhia, 2014). In the context of traceability, supply chain maps are used which are geographical representations of the network of supplier of a firm. These interactive maps are relying on innovative IT solutions to graphically represent the movement of the products across the value chain. For instance, Nike published its supplier list in an interactive map which includes all their factories, in this way enhancing transparency in supply chain management (Ditty et al., 2019b).

There are two ways in which brands and retailers communicate with their stakeholders through web (Moreno & Capriotti, 2009). First, using the web in an unidirectional way with the aim to disclose information and to influence the stakeholder's perception about the brand. Second, using web as an interactive tool which allows a bidirectional and multi-directional communication between brands and stakeholders, to create trustful relationships. The involvement and engagement of stakeholders in the sustainability issues of a brand allows brands to create shared value with them. The dialogue with and the engagement of stakeholders is facilitated by using interaction tools such as blogs, forums, platforms, interactive surveys, opinion forms, chat rooms and online communities that support the involvement and the feedback loop (Moreno & Capriotti, 2009; Siano et al., 2016). Indeed, nowadays, an increasing number of brands are dedicating parts of their websites to CSR issues and sustainable initiatives to disclose information about their supply chain and about their commitment towards sustainability (Siano et al., 2016). For instance, Patagonia's "Footprint Chronicles" webpage offers visibility into its value chain. The web page provides a global map of the textile mills and garment's factories including details about each company, a photo of their facility and the date of the beginning of their supplier relationship (Ditty et al., 2019b).

In the last years, organizations switched from providing just a summary of sustainability issues in the annual report to creating a sustainability report entirely dedicated to environmental and social initiatives and issues and communicated via web (Lodhia, 2014). Often, these reports are drawn on some principles established by international organization, like for example Global Reporting Initiative (GRI) (Siano et al., 2016). The corporate participation in GRI is a voluntary initiative of the brands, thus it suggests their commitment to a transparent communication. Sustainability communication might improve brand reputation if there is a consistency between what is communicated and the effective actions implemented by the brand, otherwise brands risk to be accused of greenwashing (Siano et al., 2016). Moreover, brands may gain a strategic advantage in managing their relations with stakeholders. However, many companies are still reluctant to fully communicate and disclose their sustainability practices through their websites, even if they are committed to address the sustainability issues, due to the fear of being attacked and criticized by NGOs which usually verify whether or not the communicated practices are actually implemented (Da Giau, et al., 2016). Since the fashion supply chain is complex, dealing with sustainability issues of the entire supply chain results to be very challenging; companies are trying to avoid the risk of communicating their sustainability practices, while they do not have full control over their supplier practices.

3.3 Technology for SSCM

The extent and the complexity of the fashion value chain makes it difficult for firms to gather reliable information about their suppliers and the activities performed by them. Thus, several technologies have been developed and used to collect, trace and manage the data. Among these technologies there are several traceability tags such as barcodes, RFID tags, and blockchain technology and management systems These technologies allows to identify, trace and track the products along the value chain as well as to monitor the material and information flows in order to integrate the supply chain (Kumar, 2017). Indeed, a brand may know in real time where a semi-finished or finished product is located and to find out timely any non-compliant product. Therefore, in the fashion industry, technology is playing a crucial role not only in transforming it but also in integrating it as a whole.

3.3.1 Traceability tags

A traceability tag represents unique identity number which identifies/ maps the physical product with the traceability information (Kumar, 2017). Since the traceability is used with several aims such as product security, tracking and counterfeit detection, the information incorporated in a traceability tag depends on the targeted functionality. The tags can be attached to or

incorporated into a product There are several types of traceability tags used in the fashion industry: barcodes or QR codes and RFIDs.

Printed barcodes/QR codes

The barcodes and QR codes consist of an image or a systematic arrangement of codes that encompasses information about the product encoded in a form of geometric shapes and use optical scanners to read labels (Kumar 2017; Agrawal et al., 2018). The barcades are similar to the read only RFIDs which do not allow to the modification of information, thus in order to change the information contained in a barcade, it has to be replaced (Nayak, Singh, Padhye, & Wang, 2015). Due to high readability, low costs and ease of decoding using smartphones camera, barcodes claim an increasing popularity for tracking in logistic operations. However, they can be easily copied and used by counterfeit products (Agrawal et al., 2018).

The radio frequency identification tags

The radio frequency identification (RFID) is a traceability-based technology representing contactless tags containing an electronic microchip which can dynamically store information. and antenna for communication of the information by radiofrequency to its environment (Agrawal et al., 2018). The RFID is a technology that enables the Internet of Things, thus the products are becoming intelligent.

The RFID and barcoding systems are aiming at identifying the products. However, RFID is more advanced over barcode in terms of proximity communication, information memory and communication ability, thus it is progressively replacing barcodes (Nayak et al., 2015). Compared to barcode, RFID can store a higher quantity of information and it is more accurate. It consists of three elements which are the RFID tag (also known as transponder), RFID reader (also known as transceiver or interrogator) and a software for data processing (Nayak et al., 2015).

RFID technology provides the ability to track and trace semi-finished and finished products, identifying their location and the information associated to their processes, thus improving production control in real time. In fashion industry, it is used in manufacturing, inventory control, logistics, retailing, supply chain management and product tracking (Cianfanelli & Goretti, 2017). According to Nayak et al. (2015), RFID technology can solve several issues in the fashion supply chain; in garment manufacturing RFID can be used to avoid product and component mixing and to improve the information accuracy. In overseas transportation RFID

can be used to track and trace the shipping before and after Free on Board, whereas if a product is outsourced to a contractor or subcontractor RFID can solve the problem of sorting and tracking timely the product, thus reducing the lead time of the distribution. Among the brands that are using RFID technology in their operations are Prada, Benetton, etc. (Cianfanelli & Goretti, 2017).

The RFID tags are widely used due to their high readability, small size and high-memory storage, however similar to barcodes, they are prone to counterfeiting. The attackers can duplicate the tags and break the security algorithm to modify the information (Nayak et al., 2015). Moreover, they requires a special device for their reading and could present privacy issues (Agrawal et al., 2018).

3.3.2 Blockchain technology

Blockchain technology represents an information system consisting of a distributed database of records that are shared among the blockchain partners, aiming at improving transparency and traceability of information (Saberi, Kouhizadeh, Sarkis, & Shen, 2019). Pournader, Shi, Seuring, & Lenny Koh (2019) state that "*blockchains are ledgers that record transactions in a trustless environment and are protected by the science of cryptography*" (p.2). Blockchain technology first become popular in 2009 as a platform for managing Bitcoin, a digital cryptocurrency (Fu, Shu, & Liu, 2018). However, currently, it has further implications in supply chain management and logistics (Saberi et al., 2019).

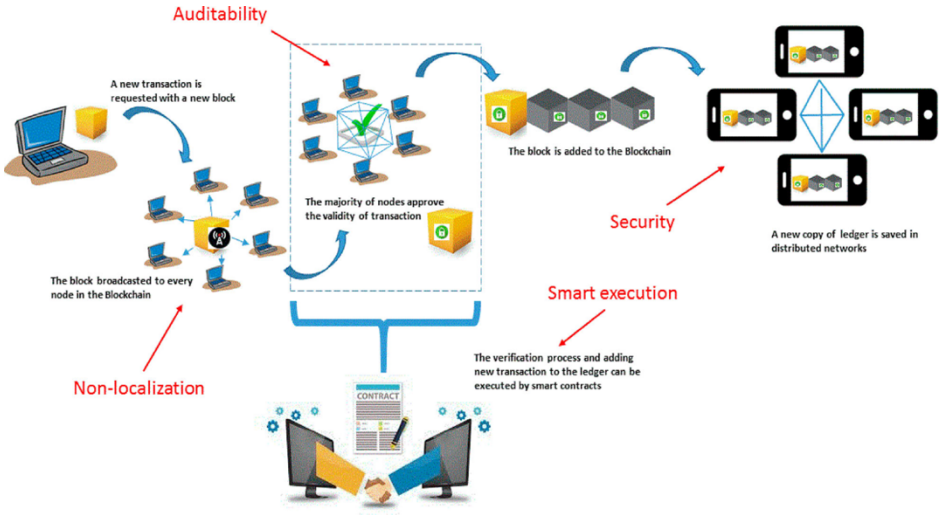
According to Steiner & Baker (2015), blockchain technology differs from existing centralized information management systems through four features: *decentralization*, *auditability*, *security* and *smart execution (Figure12)* (as cited in Saberi et al., 2019). Indeed, in the blockchain, a member can create a new entry to be added to the blockchain. The entries could be transactions, contracts, assets, or anything else that can be digitally expressed through smart devices (Fu et al., 2018). This transaction is spread and *delocalized* to every node[9] of the blockchain for the inspection of information. This implies that there is no need for a third party to verify the transaction. Once it is *audited* and approved by all the nodes of the chain according to the established rules, the transaction details are added to the blockchain ledger. Meanwhile, a record of that transaction is saved in distributed networks for *security*. While the transaction

[9] A node is a client on the blockchain that has a copy of the same blockchain and can add data to the blockchain (Pournader, Shi, Seuring, & Lenny Koh, 2019).

can be executed through *smart contracts* which enables the realization of trustful transaction without third parties' implication (Saberi et al., 2019).

Therefore, blockchain results in a distributed, transparent and trustworthy database which allows to guarantee the traceability, trustworthiness and the legitimacy of information necessary for an effective supply chain management. The application for the blockchain could be related to the tracking of potential environmental and social concerns. A blockchain-based supply chain could provide better assurance of the respect of human rights and environmental performance through the transparent record of product history (details about when, where and by whom product was made) and its verification and through the connection of blockchains with RFID. In addition, supported by blockchain and by smart measurement devices, the carbon footprint of supply chain can be measured and traced accurately with less human labour (Saberi et al., 2019; Fu et al., 2018). Moreover, since the information in the blockchain can be recorded only by the its authorized members, it can help to identify unethical suppliers and counterfeit products (Saberi et al., 2019).

Figure 12: Steps in blockchain transaction and information



source: (Saberi et al., 2019)

Although it is still in early stages of its development, it has the potential to be implemented in the fashion industry to trace the origin of the products and raw materials, access real-time inventory levels and to provide operational improvements (Pisani, Escobedo, Saito, & White, 2017). For instance, Martine Jarlgaard, an London-based designer, collaborated with Provenance, a digital company, to use blockchain technology to track the history of an alpaca jumper from the farm to the finished garment (Ellen MacArthur Foundation, 2017).

CHAPTER 4 – THE CONTEXT AND THE METHODOLOGY OF THE EMPIRICAL ANALYSIS: THE DENIM VALUE CHAIN

Introduction

After a general analysis of the fashion system and the management of the sustainable fashion value chain, the research tries to focus on a specific sector of the fashion system – the Italian denim sector, in order to understand the sustainability issues faced by it and to evaluate the practices adopted by the value chain players to become more sustainable. The focus of this research includes those players of the denim value chain that stay behind the brands and, usually, tend to be invisible to the end consumers, hence all the upstream suppliers involved in the creation of the denim garments.

Denim is one of the fabrics that probably has the greater environmental impact, due to the use of cotton as the dominant fiber and to the use of high quantity of water, energy and chemicals during fabric production, processing, and garment finishing. According to the "True price of Jeans" report by (Impact Institute, 2019), a typical pair of jeans – one made from cotton and denim produced in India, sewn in Bangladesh, then ultimately sold in the Netherlands – is said to have a hidden environmental and social cost of €30 which are not included into the retail price, but are paid nonetheless, for instance, by the local communities through scarce water use and water pollution, by the future generations through climate change, or by the employees through unsafe working conditions, long working hours and underpayment. Therefore it is necessary to improve the sustainability and the transparency of the denim value chain in order to reduce the external costs imposed to the society.

Moreover, Italy is known as a hub for premium denim garment production, with some areas individuated as the "Denim Districts". Indeed, the official denim district of Italy is the "Jeans Valley of Pesaro and Urbino". However, also the Veneto area is claimed as a denim district, although officially it is not an autonomous district, but included in the textile-clothing district, due to the presence of numerous denim brands located in this area and small and medium firms and workshops specialized in denim manufacturing and finishing. Thus, the denim industry represents an ideal context to analyse the sustainability performance and the management of the practices performed by the suppliers part of the value chain

The majority of the studies concerning the sustainability issues and SSCM in the fashion industry, are generic in nature and do not focus on a specific sector. Therefore, there is a gap in the literature concerning the sustainability issues and practices of the denim value chain. Most of the studies analyzing the denim sustainability are focusing on a certain phase of its

production or on the study of an application of a specific technology or a chemical product. This implies that there is a lack of studies that investigate the sustainability approach of the entire value chain, starting from yarn manufacturer to denim garment finishing, together with the supporting industries (chemical and technology manufacturers). However, the majority of the studies that deal with the sustainability in the fashion industry, are analysing it from the point of view of the practices and actions implemented by the brands alongside the value chain without considering and investigating the implications faced by all the small suppliers that are upstream. A reduced number of studies are investigating the sustainability from the point of view of the upstream suppliers and quite all of them are focusing on the leather value chain. Another issue concerns the absence of studies that integrate the sustainability and the traceability aspects together and the lack of studies that fully deal with the two dimensions of sustainability: most of the authors focus exclusively on one aspect (either environmental or social) without integrating them with each other. Thus, this study aims at closing the literature gap and to perform an analysis of the sustainable practices both environmental and social of the entire denim value chain by focusing on its upstream players, and to investigate the current state of traceability of the Italian denim value chain.

4.1 The context of the analysis: the denim value chain

4.1.1 Denim – characteristics and evolution

Denim, a cotton woven fabric, can be considered a very versatile article today, allowing a lot of styles and fashion. Among the textile products, denim is the one that have received the widest acceptance, as it is worn by people of all classes and ages. According to Annapoorani (2017), denim represents "*a solid twill fabric made out of cotton and dyed blue with indigo colour* " (p.16). The most famous denim is indigo denim in which the twist string is coloured in blue cotton and the weft string is left uncoloured (Paul, 2015; Annapoorani, 2017). Indeed, the denim fabric without indigo dying is not considered a reliable denim. Historically, denim was developed for cowboys as work wear, however later it became a fashionable article of style. Today denim's fashion is coming in an assortment of colors, styles and textures. Denim garment, in particular denim jeans are the type of garment that made denim famous, being one of the most used fashion item nowadays (Annapoorani, 2017). No other item of clothing has ever proved so versatile and at the same time resistant to changes in fashion and costume. For this reason, "denim" and "jeans" are often used as the same words, however, denim is the name of the fabric used to make jeans - the most commonly used type of denim apparel. Nevertheless, denim can be used to create other garments, different from jeans, such as coats, shirts, dresses, jackets, etc.. The word "denim" originates from the French "serge de Nîmes", a fabric made of

silk and wool from the town of Nîmes in France (Paul, 2015). While the name of "jeans" derives from a fabric made from cotton, linen and wool blend from Genoa, Italy, called jean fabric. The main difference between the two fabrics was: denim was made of one coloured yarn and one white yarn, while jean fabric was woven with yarns of the same colour (Paul, 2015).

Although denim originated in Europe, its wide application and culture started in USA, becoming an American icon which soon spread all over the world. In the nineteenth century, Levi Strauss created the basis of the modern denim jeans industry by founding in 1853 Levi Strauss & Co.. In 1873, together with Jacob Davis, Levi manufactured durable workwear such as overalls and trousers made of denim, making them stronger by placing copper rivets at the places where the pants ripped the most such as pockets and flies (Paul, 2015). Men who bought jeans were farmers, miners, cowboys and workers who needed their clothes to last longer and to protect them during work. This has represented the start of the legend of jeans; the blue material has survived over a century and it still remains an inspiring fabric in the fashion industry.

Figure 13: Levi Strauss & Co. – Patent Riveted Clothing

source: https://www.wsj.com/articles/SB124653990560185701

The denim sector is, in fact, the one that undergone the most interesting changes in the last decades. Several innovative elements have been added to transform denim in the today's symbol, including complex changes in spinning, weaving and finishing techniques as well as innovation in materials and dyes (Annapoorani, 2017). Although the traditional denim is made 100% of cotton, nowadays most denim fabrics are a mix of cotton (up to 98%) and synthetic yarns such as elastane or spandex, that give the ease of movement. Denim has gone from something rugged and hardwearing, to something that is refined, extremely technical and worn

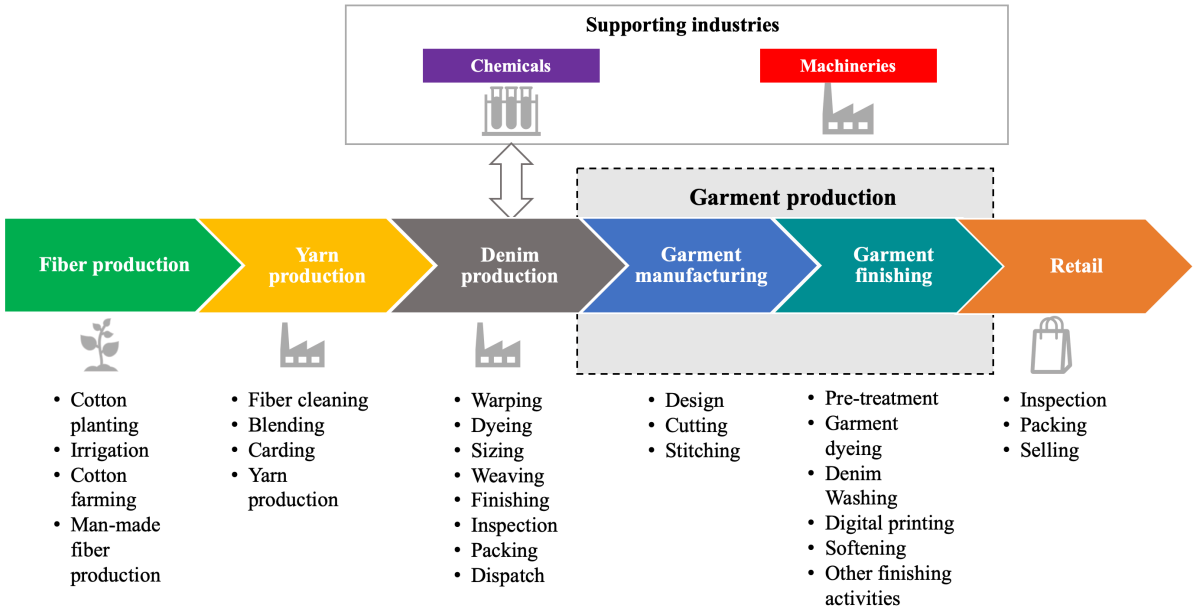
by people all around the world. At the beginning, textile manufacturers used natural indigo dye removed from plants. Over the years, the synthetic indigo dye replaced partially the natural indigo dye. With innovation and the refinement of the materials and the investments necessary to achieve good results, prices have risen. This led to the rise of the segment of the "premium and luxury jeans", with prices reaching 300 euros and more (Crivelli, 2019). According to Euromonitor International, the 70% of global market share of jeans corresponds to the value market jeans in terms of price, which sources denim textiles and other raw materials mostly in developing countries such as China, India, Bangladesh, Turkey (as cited in Bello, 2019). However, for the premium and luxury jeans, Italian and Giappanese denim emerge in quality and are used by premium denim brands (Bello, 2019; Amutha, 2017). According to Guglielmo Olearo, director of Denim Premièr Vision, the global denim market (including shirts, jeans, and other denim products) was valued at more than US$ 56.1 billion in 2017 and it should rise to US$ 59 billion in 2023, with a growth more in volume rather than in price driven mainly by the emerging countries of Asia or Southeast Asia (as cited in ANSA, 2019). Among all the denim garments, jeans are those that keep the largest revenue share, due to the high demand for distressed and casual-wear globally, especially among young people (P&S market research, 2018).

Growth in the denim market is driven by different factors such as growing working population, increase in income levels, especially in emerging countries, spread of e-commerce and adoption of western lifestyle. Moreover, the recent trend to wear casual clothes in most workplaces boosts the global denim market. However, the harmful environmental impacts of denim production may hinder the global denim market growth (P&S market research, 2018). To overcome the challenges imposed by the environmental loads, trends like the development of eco-friendly denim and sustainable manufacturing are introduced by brands. Denim, therefore, still has its cards to play, but now with an edge over. Sustainability, in fact, represents an innovative and strategic element in its development, not only in business terms, thanks to the production savings that it entails (in many cases, an initial investment), but also in reaching the consumers, which are becoming increasingly sensitive towards green practices and products.

4.1.2 The Denim Value Chain and the associated sustainability issues

Denim garment production involves several steps performed by different actors. In order to understand the sustainability issues and the potential actions to be taken to reduce the footprint, it is important to map the activities that make up the denim value chain and the relationship among the different actors. *Figure 14* reports a simplified representation of the denim value chain, including all the activities performed in a specific phase.

Figure 14: The denim value chain



source: author's elaboration

Fiber production

The actors that start the value chain are the farmers that cultivate the cotton or other plant fibres. Originally denim was made of 100% of cotton fibres, however it can be made also from blends of materials, such as the blend of cotton and other natural or man-made fibres like spandex, wool, lyocell, hemp, polyester that develop special types of denim and change its wearability. Therefore, also the producers of man-made fibres are part of the denim value chain, even if in a small part. Although many fibres are entering the denim sector, cotton remains the predominant fiber. Denim would not be denim without cotton, whose fibre quality are very important for creating a good denim (Paul, 2015). As stated in the second chapter, cotton cultivation leads to sustainability costs regarding the use of pesticides, amount of water used for irrigation, wastewater and harmful conditions for farmers. According to the report "The true price of Jeans" by Impact Institute (2019), the major producers of cotton are China (23%), India (23%), USA (16%) and Brazil (10%).

Yarn production

The cotton fibres have to undergo a series of operations to be spun into a yarn. The cotton is mixed and then prepared through cleaning of impurities, blending and carding activities which deliver a bit for spinning. The fibres are set up in a groove of a spinning rotor and twised into yarn. Unlike the weft yarn, the production of warp yarn is critical, as the quality of the denim depends mostly of this yarn (Paul, 2015). When producing the yarn, high quantity of dust and

micro dust is issued into the working environment, which if not cleaned, can affect the worker health and lead to respiratory diseases.

Denim production

The manufacturing process of denim is similar to any other garment made from cotton up to the process of weaving, with the exception that denim is dyed at the stage of sizing before weaving, whereas in the case of grey fabrics the dyeing process depends on the finished product (Annapoorani, 2017). For the weaving step, the yarn is classified into two types: warp and weft. The warping process transfer multiple yarns from individual yarn package onto a single collecting package consisting of a sheet structure necessary for the weaving machine (Annapoorani, 2017). The aim of yarn's sizing is to improve the quality of the yarn and resistance by synthetically regulating the filaments. At the sizing stage, the warp yarn is dyed with indigo, which gives the characteristic blue color to the denim (Annapoorani, 2017). If the yarn is not dyed, than the resulting denim fabric is called ecru denim, and it can be dyed subsequently after garment manufacturing (Paul, 2015). Before dyeing, the yarn is washed with chemicals such as caustic and washing soda, after it pass to dyeing tanks for oxidation and dyeing. After the dyeing process, the colored yarn is washed again with water several times before it is prepared to be woven (Annapoorani, 2017). The major issues in the dyeing process is represented by the reducing agents and techniques, wastewater and quality of the dye bath (Paul, 2015). The indigo dyes both natural or synthetic lead to wastewater during the dyeing process, while the reduction techniques and agents used in the dyeing process raise further environmental concerns.

Finally the weaving activity consists in interlacing the indigo dyed warp and grey weft to produce the denim fabric. The weaving looms used for denim are projectile, rapier and air jet looms (Paul, 2015). Weaving is the last stage in denim manufacturing and is crucial in determining the quality of the final garment. Other finishing phases, after weaving, are brushing and searing which have the aim to eliminate the impurities and to smooth the fabric. After the assessment of fabric for waving defects, uneven dyeing or dyeing defects and patches, the fabric is wrapped and sent for dispatch according to the customer's needs (Annapoorani, 2017).

Different types of denim producers can be identified based on the degree of vertical integration. There are companies that are vertically integrated and perform all the manufacturing phases from fiber cleaning, carding, yarn production to warping, dyeing and weaving. Others are more specialized on the weaving activities and outsource the yarn production to other actors that are specialized on spinning.

Garment production

Denim garment production consists of different phases as illustrated in *Figure 14*. *Garment manufacturing* represents the activity of transforming the denim fabric into a designed garment. The stitching process requires machines that are able to deal with the density of the fabric and the thickness of the seams (Paul, 2015). The garment manufacturing may lead to harsh working conditions and ergonomics. Since the denim fabric has a heavy weight and thick structure, the operators that stitch the garment should put pressure on their fingers, thus leading to their fatigue and health problems. Usually, the garment manufacturers are specialized just in the stages of cutting, sewing and/or embroidery and the garment finishing is outsourced to specialized suppliers or subcontractors.

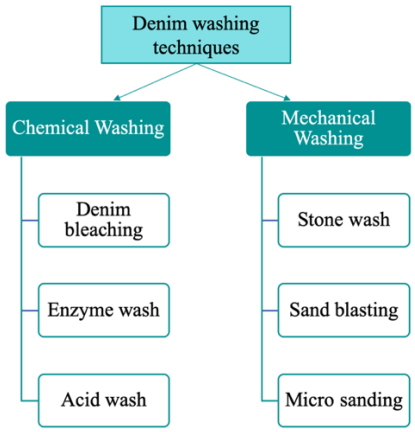
Current fashion trends are favoring the broken and worn looks that requires the end garment processing and finishing. *Garment finishing* includes several phases such as dyeing, washing, digital printing and other treatments. *Garment dyeing* is used only for the ecru denim garment, which once it is manufactured, it can be dyed in different colours and shades. Nevertheless, garment dyeing is considered to be a more sustainable practice compared to indigo dyeing of yarns, since only the fabric used in garment manufacturing is dyed, thus reducing the waste of dyed fabric (Paul, 2015). Digital Printing can be considered a substitute of garment dyeing and consists of development of different design and printing onto the garment.

The original denim garment is a blue fabric garment without any fashion appeal. Therefore, *denim washing* is a crucial step in the denim value chain as it helps to create the different effects on jeans that consumers are looking for. It represents the aesthetic finish given to the denim garment consisting in washing out partially dyes and pigments present in a fabric, in order to make it more attractive and resistant (Choudhury, 2017). Indeed, the uniqueness and creativity of denim garments derive from denim washing, which allows to create a worn-out effect or a faded look on garment. Compared to the other textile sectors, where the raw material matters the most for the attractivity of the finished garment, in the denim sector the finishing and washing effects are crucial. The effects and the shades achieved through washing represent, in fact, the innovation in the denim industry (Choudhury, 2017). Besides contributing to beautify the denim garment, it also provides some functional properties to the garment by enhancing the softness and the comfort of the fabric (Amutha, 2017). Another advantage of garment washing is to remove the impurities and spots deriving from garment manufacturing (Choudhury, 2017). The steps taken in the processing of denim garments are: pretreatment consisting of desizing,

rinsing and scouring; mechanical washing; cleaning up to adjust the desired effect; bleaching; dyeing; softening.

Industrial washing machines are used in denim washing for deliberately removing the dyes and developing new fading effects. These effects are created by employing chemicals, stones, enzymes, acid, dyes etc. Denim is either rubbed with stones or other abrasive materials, the so called mechanical washing, or treated with chemicals, bleach and other substances, known as chemical washing (*Figure 15*) (Choudhury, 2017). In this context, the supporting industries including the producers of finishing technologies and the producers of chemicals are of a great importance and contribute to the innovation in the denim sector, as thanks to their products and technologies new effects and more sustainable techniques can be developed (Amutha, 2017).

Figure 15: Denim washing techniques



source: (Choudhury, 2017)

All these processes have a high environmental and social cost. Pumice stone is used to wash the denim garments with stonewash, which produces high impacts. Indeed, this stone has to be extracted from quarries and transported, hence creating high environmental costs. During the washing process, the stones spreads micro dust in the workplace, which can be inhaled by workers and causing health problems. Moreover the micro-dust enters into the treated garment and requires a lot of manual word to remove it. The stone can cause damages to the machines and to their filters and impose costly and continuous cleaning and maintenance operations. In addition to this, the waste water resulting from stone wash contains powder of pumice stone which create an impermeable sludge and as a consequence the costs of purification of wastewater and of sludge disposal are very high. In addition, a huge amount of water is used for removing the powder of the pumice that is created when the stone gets abraded from the denim (Amutha, 2017).

The sandblasting is a mechanical finish that uses sand containing silica. The silica dust is released into the air and creates respiratory diseases, such as silicosis and tuberculosis, thus

putting at risk the health of the workers. Chemical washing consists of bleaching which uses several chemicals that might be dangerous for human health and environment. Acid wash uses both pumice stone and chemicals. This type of washing does not require the use of water but it creates other issues (Amutha, 2017). The wastewater resulting from denim dyeing, washing and finishing have different chemicals inside. In this context, the denim washing and finishing industry should strive to develop more sustainable techniques and practices that could replace the traditional wet treatments. Thus a system that treats and recover the dyes or chemicals and allows to reuse water is essential.

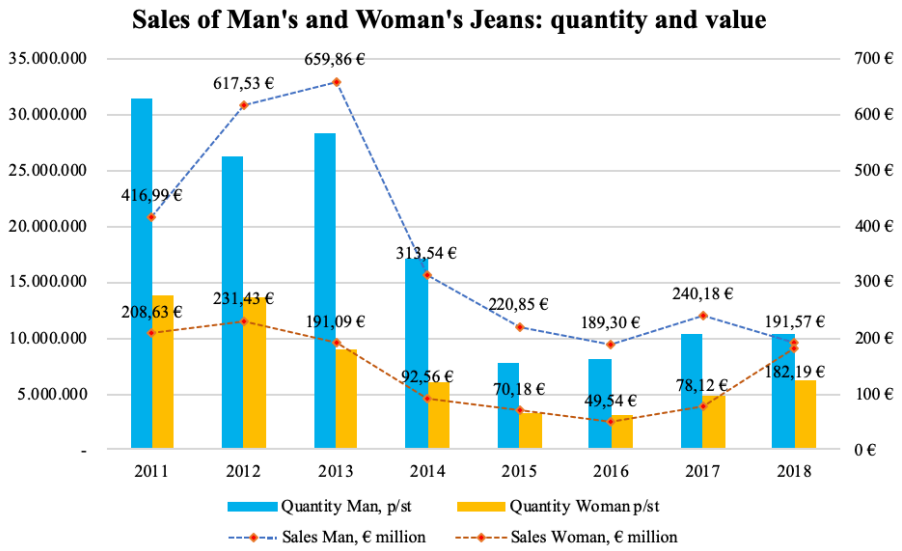
4.1.3 The Italian Denim industry in the global market

Worldwide denim production is huge; 2,7 billions of meters are produced every year and two billion pairs of jeans are sold ananualy (Fashionunited, 2016; Impact Institute, 2019). Where once Italy and USA were the major producers of denim, however the denim production for the masses changed this trend, by shifting the market to cheaper countries. If we talk about quality, there are only two nations that emerge: Japan and Italy. According to the report by Impact Institute (2019), China is leading the market of denim by producing the 24% of the global quantity of denim production, followed by Pakistan with 18%, Turkey – 12% and India with 9%. With regards to the market of denim finished garments, Bangladesh is manufacturing the 27% of the global produced jeans, most of them exported to Europe. Turkey is producing the 23% of the global production of jeans, followed by Pakistan with 16% and China producing only 10% of the global production (Impact Institute, 2019). Although the Italian denim industry is not among the lead producers of denim and jeans, it is known for its premium offering and quality. Indeed, the Italian denim industry has been the forerunner of denim devepolments with several important mills like Tessitura di Robecchetto Candiani (now "Candiani Denim") and denim brands like Diesel, Gas and Replay.

In addition to offering high quality products, the Italian denim industry anticipates market trends in denim due to the impact of the Italian taste on fashion (Martens & Turra, 2012). According to Alberto Candiani, a denim expert who runs the Italian mill "Candiani Denim", the characteristics that distinguish the Italian denim industry from those in other countries are "*taste, creativity, innovation, a finer aesthetic and hand feel*" (as cited in Donaldson, 2018). However, Alberto Candiani considers that making denim in Italy is 25% more expensive than making it in Turkey, which represents the strongest competitor of Italy, and probably 50% more than India, Pakistan and most of the Far East countries (Donaldson, 2018). Due to the rise of low-cost denim producers such as India, China, Turkey and the harsh competition from

developing nations, in 2005, the denim sector in the developed nations such as USA and Europe faced a downturn (Annapoorani, 2017). Thus, in the last decade, the Italian denim industry has passed through a heavy period as the production units decreased, forcing the Italian brands and manufacturers to find new strategies to remain relevant in an increasingly competitive environment. Not being able to compete on costs, many firms closed their activities and most of the Italian brands have decided to develop new fabrics and patterns in denim business and to reposition their products in the premium or luxury segment (Bayer, 2018).

Figure 16: Sales of Italian Denim jeans and short for women and men: quantity and value

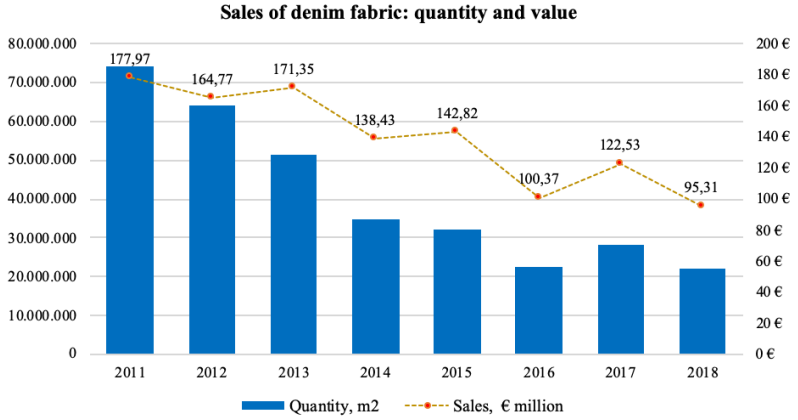


source: author's elaboration based on dati.istat.it

Compared to 2011, when Italy sold 31.3 millions of produced men's jeans and 13.8 millions of woman's jeans for a total of 45.3 millions of jeans, in the following years the total sales of Italian jeans decreased considerably (-63% in 2018). According to ISTAT the total production of Italian denim jeans and shorts sold reached 16.6 million pieces in 2018, of which 10.4 millions are represented by man's jeans and 6.2 million by woman's jeans, for a total value of € 373.76 million. Likewise, the sales of Italian denim fabric decreased both in quantity and value over time. Contrariwise to year 2011 when the quantity of sold denim was of 74 million m^2 for a value of € 178 million, the quantity of Italian denim fabric has decreased by 70% in 2018 and the value of sales by almost 50%, reaching 22 million m^2 of fabric for a total value of € 95.3 million. This could be due to the reduction in exports and to the increasing competition from developing countries manufacturers. According to the analysis developed by Confindustria Moda, Italian denim fabrics, in fact, lost 14.2% in exports in value in 2018. Nevertheless, the Italian jeans' exports fell by 2.2%, while imports increased by 3.6%. This situation is due to the reduction of exports of woman's jeans (-7.6%), on the other hand, due to

a slight growth of man's jeans (+ 1.3%), historically the main business of Italy (it represents over 60% of the total export) (as cited in Bello, 2019). Indeed, as can be noticed from *Figure 16*, the production of man's jeans exceeds that of woman, though in 2018 the production of woman's jeans increased by 26,18% compared to 2017.

Figure 17: Sales of Italian denim fabric: quantity and value



source: author's elaboration based on dati.istat.it

The quality of the fashion products are increasingly popular with foreign customers. Having pushed the accelerator on the quality and refinement of the product seems to be paying off. This is confirmed by the data on foreign sales in 2017: exports of made in Veneto fashion products have exceeded 10.4 billion euros, recording an increase of + 3.5% on an annual basis, mainly concentrated on the European markets.

4.1.3.1 Denim "made in Veneto"

The north of Italy, and in particular the Veneto region, could be considered the homeland of modern made in Italy denim. Here, precisely in the early 1980s, Adriano Goldschmied, a protagonist in the birth of sportswear with brands like Americanino and Goldie and still considered the "Godfather of denim", gathered around him a series of creative designers that gave life to the Genius Group (Garavaglia, 2014). At that time Claudio Buziol and Attilio Biancardi, Enzo Fusco and Renzo Rosso were part of the Genius Group. Thanks to the experience with Goldschmied, the first two founded Replay, Fusco the Fgf Industry and Rosso the Diesel (Garavaglia, 2014). In total were 14 brands part of the group. The idea behind the Genius group was to share knowledge about product development, marketing in order to improve their brands image and to transform jeans in a cult object. Other historic denim brands located in Veneto are Carrera, Gas, Jacob Cohën, Tramarossa - realities that have made innovation and specialization the way to success, using a popular raw material, denim, making it an international must. Giada SPA, a company founded by the Tato Bardelle, in the 70s created

the famous Americanino and Frank Scozzese brand. In 2003 his son Nicola relaunches Jacob Cohën brand, founded by his father in 1985, revisiting jeans as a tailored product through research on fit, on the origin of the raw material and characterized by the production entirely made in Veneto (Bulbarelli, 2012). The brand's success is the added value given by the dialogue with the territory that generates innovation and care for the product.

Given the presence of the numerous denim brands in Veneto, specialized companies were born to respond to the commission from brands thanks to a direct interaction and a flexible offer. Through the fragmentation of the supply chain and outsourcing, a series of small and medium companies and workshops specialized in denim processing, contractors services, denim garment manufacturing and finishing have been rising. Over time, these realities have developed skills and know-how that allow them to produce high quality and styled fabrics and garments thanks to the interaction and relationships with the various players in the supply chain. Indeed, alongside denim producers and garment manufacturers, a number of companies have developed that are producing garment finishing technologies and machines, becoming a reference point in the denim value chain, especially for many local laundry and dyeing companies.
Among the denim producers that stands out in Veneto is “Berto Industria Tessile” which is producing a wide range of high quality denim, satisfying the requests of designers and stylists (Berto, n.d.). Contrariwise to the denim fabric production, the Veneto area is populated by numerous denim garment manufacturing firms or workshops. The manufacturing companies can be divided into two types: specialized workshops or subcontractors that carry out only the cutting and stitching on behalf of third parties and the contractors (service) which are companies that follow the entire production process of the commissioned products. Sometime, contractors may commission the garment manufacturing to laboratories as well. In the first case, in which the garments are commissioned directly by the brand to manufacturers, the brand owner have to take care of following the entire process and "moving the garment" in the different workshops along the supply chain. In the second case, the process is followed by a contractor who interfaces with all the suppliers and responds to the brand owner by delivering the garment only once it is finished.

The workshops receive the orders directly from the brands or from the contractors, who act as intermediaries, commissioning only the garments manufacturing. Although the success of the Italian denim is linked to the presence and the relationship with the highly specialized subcontractors, which are often small artizan firms, these firms are often invisible to the market.

Thus, behind big fashion brands, there are numerous local workshops and small firms that are offering an high-level of skills, creativity and know-how but that are often unknown to the market (Progetto Filiera Fantasma, 2019). Given the presence of skilled manufacturing workshops, many contractors are interfacing with international luxury brands, exploiting the added value given by the territory and the skills of the laboratories. For instance, contractors such “FashionArt ” which designs and produces luxury denim garments for brands such as Chanel. The company, thanks to its expertise, is able to work alongside the client (brand) for the entire production process, from coming up with the idea to the final product. Other contractor is “Project Officina Creativa”, which provides its services to several luxury brands including Valentino.

The innovation in denim industry is given mainly by the finishing and the fit, in continuous evolution. The garment finishing is performed by industrial laundries who carry out activities like dyeing, washing, and other finishing treatments. The laundries are a fundamental step in the denim value chain. Through innovation and experimentation and through the close collaboration with the brands and with the suppliers of garment finishing machines or dyes and chemicals, laundries are able to create new trends and exclusive effects. Indeed, denim continues to remain a hit, as it can be transformed endlessly due to its continuous evolution in terms of treatments and effects. There are no other fabrics that enable these kind of experiments and treatment techniques (Zargani, 2005). In Veneto are present several firms specialized in denim washing and finishing treatments, such as Blue Jeans Lavanderie, Everest, Cleantex etc., which attract not only Italian clients but also international ones. The Italian denim industry is a leader in denim washing, however, now companies specialized in finishing treatments are suffering due to high costs (Martens & Turra, 2012).

Other important actors in the Denim District of Veneto are part of the instrumental mechanics sector, which are specialized in developing new technologies for the industrialization of the stages of denim garment manufacturing. For instance, firms such as Nexia, Tonello, Omi Wash are producing washing and dyeing systems for garment finishing which guarantee maximum performance.

The entire value chain is governed by the lead firms (brands or retailers) from which the request for orders for the new collections comes, but also to which the finished garments are delivered to be sold. In this case there are companies that operate directly following the entire supply chain, while others entrust production to contractors and receive the garments from contractors

only once they are finished. In other cases the companies can give the brand license following only the creative part. The majority of Italian brands operating in Veneto are belonging to high-end fashion segments and bridge segment. The various brands are sometimes part of a fashion group which have in their portfolio several prestigious brands, in order to create synergies and economies of scale as well as diversify their offer both in terms of distribution, brand positioning and country risk. For instance, the OTB Group which owns brands such as Diesel, Dsquared, Maison Margiella, Staff International and Fashion Box which owns brands like Replay, Replay and Sons and We are Replay. Giada Spa which has the license of brands like Jacob Cohën, Karl Lagerfeld Denim, Vilebrequin Denim and owns the Hand Picked brand.
While some of the lead firms keep only their headquarter in Veneto and outsource their production in lower-income countries, many of them still maintain their manufacturing process in Italy, producing made in Italy or made in Veneto jeans and denim garments exploiting the know-how and the creativity of the local manufacturers, laundries and denim producers, by offering their products to a niche public with a high economic availability and with a culture that allows it to enhance and appreciate the garment (Albamonte, 2013).

The interaction between companies, given both by proximity and by economic relationship, has allowed the development of a series of unconventional interactions that are not governed by economic aspects, but by the relationships between the different actors; these relationships represent a competitive advantage coming to reduce opportunism and therefore relations between companies are more stable and lasting (Martens & Turra, 2012).

4.1.3.2 The Ghost Makers

Since the denim value chain includes numerous small workshops and subcontractors that work on behalf of brands owners and contractors, these laboratories are unknown for the final customers and for the brands. The fashion system of the Veneto region includes many outstanding firms and manufacturing workshops that are very good at doing fashion but they are largely hidden (Progetto Filiera Fantasma, 2019). As presented in the last paragraph, behind the big brands, there is a universe of laboratories that offer creativity, skills, energy and know-how of the highest level, but they are often invisible to the global market and to the international brands.
“Project Officina Creativa”, a denim and sportwear maker for luxury brands decided to deal with this issue and to launch the project of Filiera Fantasma called “The Ghost Makers: l’universo sconosciuto dei laboratori veneti”. “Project Officina Creativa” produces denim & sportswear clothes for luxury Brands, offering a unique, efficient and accurate service to create

high quality products, totally Made in Italy. It is providing product research, selection of fabrics and accessories, colors, dyeing, washing and printing techniques research, modeling management, prototyping, sample creation and production of the commercialized items. In order to provide Brands with innovative and trendy garments, they are collaborating closely and continuously with their customers (Brands) to improve and maintain the identity of the Brands (Project Officina Creativa, n.d.).

The Ghost Makers project launched by Project aims at gathering this precious heritage of Veneto in a single platform, easy to be integrated and consulted, free for participants, so as to present it correctly and effectively to global brands of luxury fashion. The issue from which starts the idea of Filiera Fantasma is that the small firms and workshops from fashion districts are very good at creating high-quality and creative products, thus the luxury brands are always searching for them, however they are often invisible resulting in the so called "Ghost Makers". The luxury fashion market in the world is becoming increasingly wide, varied, differentiated. Many leading brands, old and new, are looking for the skills and abilities common in the Veneto region. Many of them know about manufacturers and appreciate how they are doing fashion, but there are also those who do not know them (Progetto Filiera Fantasma, 2019). Thus, the idea of the Ghost Makers project is to make visible the actors involved in the fashion value chain and their know-how, in order to enhance the transparency in the value chain and to facilitate the sourcing decision making of luxury brands. Increasing transparency implies that brands will know where and who are producing their products, in which conditions, with which technology and whether they respect the regulations and the required social and environmental principles.

Figure 18: Poster - The Ghost Makers Project

source: (Progetto Filiera Fantasma, 2019)

The author of the thesis is collaborating with Project Officina Creativa in the realization of the first step of The Ghost Makers project, which will cover, in this first stage, the denim garment manufacturers of Veneto area. The garment manufacturers considered in this research were those that manufacture (cutting, sewing, ironing) and do not own proprietary brands and are not a service (contractor). The way these manufacturers were selected will be presented in the methodology part. Although currently we focused on denim garment manufacturers, the project is intended to be extended further to the other phases of the denim value chain, such as laundries and textile manufacturers and to other garment value chain.

The requirements for companies that wish to be part of it are to respect the ethical principles of Social Responsibility, the current regulations and the chemical safety requirements (Progetto Filiera Fantasma, 2019).

The advantages for participants of being part of the Ghost Makers project and being visible are several, including (Progetto Filiera Fantasma, 2019):

- **Introducing themselves** by manifesting their value and excellence in the right way, in order to be noticeable and chosen by leading brands;
- **More partnerships and an insurance for the future**. Those who process, finish and manufacture garments and accessories on behalf of the big brands often live of the exclusive relationship with one or few customers only. Depending just on one or some brands could make the manufacturers vulnerable to situations whether there are drops in volumes produced or whether the brand changes its partners. Thus, by being more visible, manufacturers might be more assured for the future.
- **New partnerships and growth possibilities**. Making workshops visible means increasing the number and quality of possibilities for collaboration.
- **Better payment for an excellent work**. Identifying collaborations, also international, at the top end of the fashion pyramid, means finally giving their work the right value and see it rewarded correctly and adequately.
- **Selecting brands**: Being able to choose with whom to work is a great chance; it means being able to foresee, plan and to create opportunities for the company and for all the people who collaborate with their know-how.
- **Many talents in a single platform,** accessible for everyone. Joining in a single platform means networking, sharing and spreading an unique message of values which highlight the excellence the brands need.

The advantages for brands are to identify and to choose the laboratories with whom to work, based on their know-how and high-offered value. The ability to trace in a simple way all their

suppliers and to be transparent about their value chain by offering important information to customers about who made their clothes. The project aims not only at providing visibility to the actors that stand behind a brand, but also to trace the sustainability actions both in terms of environmental and social sustainability at the involved firms.

4.2 Empirical setting

4.2.1 Research aim

In the previous section, a general overview of the Denim value chain and Denim District of Veneto is presented alongside with the Ghost Makers Project. As emerges from the analysis of the denim value chain, it has an high environmental and social cost. It was estimated that producing a couple of jeans are used more than 2500 gallons of water (including cotton farming, dyeing and processing of denim), high quantity of energy (in processes such as spinning, weaving, sewing and finishing) and quite a pound of chemicals in terms of dyes, auxiliaries and agents (American Chemical Society, 2012). If we multiply these numbers by four billion, which is the number of denim garments produced globally each year, the result will provide the amount of environmental footprint such as wastewater and greenhouse gasses produced by the denim industry (Nature - Editorial, 2018). If the quantity of produced denim garments is increased, as forecasted by the P&S market research (2018), the environmental footprint will create problems for the earth and for the industry players. Thus, sustainability is becoming a main topic in the denim sector. With total denim production on a continuous upward trajectory, supply will surely outpace real demand making landfill capacity a significant issue in the future. Circular systems and production practices will become increasingly requisite; and fully transparency and traceability will become the new measures to evaluate the performance.

Although sustainability is becoming an increasingly relevant topic, the available literature addresses the topic in a generic way, hence a complete vision is missing focused on the relevance that suppliers have, in terms of sustainability in the realization of the finished product. So far, in fact, most of the studies carried out have highlighted what was declared by the brand; this cannot be enough to frame the actual level of sustainability currently achieved by the premium denim supply chains. The point of view adopted in this study is that of the suppliers, which are often workshops and medium-small enterprises and therefore present different problems from those encountered by the big brands. By evaluating directly the practices developed by those who produce the denim fabric and who stitch and finish the garment it is possible to identify the current state of the value chain with respect to sustainability issues and to understand the actions taken into the industry to address them. From the raw material to the sale of denim garments, the product goes through a series of phases that can be internal or

external to the lead buyers. Although the brands coordinate the entire value chain alone or with the support of specialized contractors that act as intermediaries between brands and the upstream suppliers, they are not able to control and monitor entirely all the players involved in the garment production. As the denim district includes several actors that produce and process denim garments for the premium brands, it would be interesting to investigate the latest developments coming from the district for denim both in terms of sustainability practices and the contribution of the key actors in transforming the industry in a more sustainable and transparent one.

Starting from these premises, the following research questions are investigated:

1) *What are the drivers and pressures that encourage or push supplier companies to move towards sustainable development and who are the actors that most promote sustainability in the denim value chain and how?*
2) *What are the current environmental and social sustainability practices and actions implemented by the Italian companies operating in the upstream part of the denim value chain at the product, process and value chain level, and on the basis of these to identify and determine the sustainability approach pursued by them and the barriers and benefits encountered during their implementation?*

Traceability and transparency of the value chain is increasingly important in the fashion industry, and this is true for every type of fashion product, including denim garments. Since denim has a high environmental and social cost, traceability and transparency could allow consumers, brands and other stakeholders to understand exactly where and how resources are used. Moreover, emphasizing product origin and the quality of Italian denim and apparel represents also a branding strategy that improve the brand image. Furthermore, the sustainable development together with a traceable value chain can be supported by the use of advanced technologies. Therefore another aims are to understand:

3) *How transparent and traceable is the value chain and how the actors monitor and trace their impact on society and environment and implementation challenges?*
4) *What is the role of available technology in upgrading the value chain by making it more transparent, traceable and sustainable?*

Although the research focuses on the upstream suppliers of the denim value chain, it aims at identifying the main critical issues emerging from the perspective of suppliers regarding the management of sustainability, and based on these to underline the implications for brands in spreading sustainability upstream in the value chain.

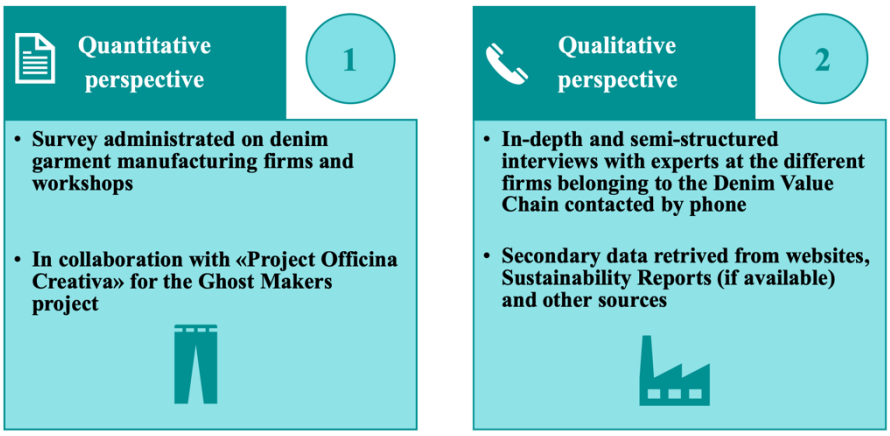
4.2.2 Research Methodology

Sample selection

In order to provide a better understanding of the sustainability practices in the denim value chain, the author has moved in two directions (*Figure 19*): a quantitative analysis starting from a reasoned sample of garment manufacturing companies, and then a qualitative analysis performing in-depth interviews with the remaining actors of the denim value chain.

The **quantitative method** consists in a survey that have been designed by the author and administered in collaboration with "Project Officina Creativa" for the Ghost Makers Project. Based on the requests and needs of the Ghost Makers project, the firms included in the sample are Italian firms located in Veneto area which are manufacturing denim garments such as jeans, shirts, jackets, dresses, etc. The selection criteria for firms included in the sample have been to perform just the manufacturing activities such as cutting, sewing, ironing on behalf of others and to not own proprietary brands, thus they manufacture the garments for a business-to-business (B2B) market which includes brands and contractors.

Figure 19: Research methodology approach



source author's elaboration

Nevertheless, the firms enclosed in the sample are Italian firms or workshops with regard to both the ownership and manpower. This implies that from the sample have been excluded firms that possess either non-Italian ownership or employ non-Italian workers. This criteria was used in response to the current situation in the Italian fashion system which sees many foreign firms located within or near the area of industrial districts. For instance, the presence of Chinese manufacturing firms or Chinese workers concentrated in the Prato area in the last decades is an examples of the current situation of the Italian fashion system (Max, 2018). The presence of

foreign producers that produce in Italy, leads to the risk of confusion of the “Made in Italy” label. The immigrant producers are often criticized to ignore social and labour norms by employing irregular workers or undocumented immigrants that face unsafe workplaces and long working hours (Max, 2018). As this quantitative research is employed also for the development of the Ghost Makers project, in order to make visible the Italian know-how and the artisanal craft experience typical of the Italian tradition necessary for the Ghost Makers project, the research avoided the non-Italian workshops. Furthermore, since many of the foreign firms located in the apparel-textile districts are suspected of not respecting the current regulations in terms of sustainability practices, and the requirements for companies that wish to be part of project are to respect the ethical principles of social responsibility, thus the non-Italian companies are considered not suitable for the project, and as a consequence for the current research.

The identification of the surveyed workshops and firms was provided by the “Cucirini Rama”, a company producing sewing threads, with whom Project Officina Creativa collaborated in the identification of suitable firms for the research and in the administration of survey. Among the 100 firms and workshops operating in the garment manufacturing sector, only 30 firms met the selection criteria. As a consequence, the sample was composed of these companies and the survey have been administrated to them by the “Cucirini Rama” agents.

The **qualitative and explorative method** of this thesis consists in a case study methodology with experts interviews designed and administered by the author under the supervision of the Professor Eleonora di Maria from the Department of Economic and Business Sciences "Marco Fanno" of the University of Padua. The case study methodology is appropriate for an exploratory research to achieve in-depth results.

The companies part of this research have been identified and chosen based on some important factors. First, the companies have to be located in the North of Italy, especially in the Veneto area and to operate as a supplier in the denim industry. Second, the companies have to be representative of each phase of the denim value chain, starting from yarn production and ending with the subcontractor activity, in order to study the entire context of denim value chain. Thus, the firms included in the analysis are Italian firms which are part of the denim value chain, from yarn manufacturing, passing through denim manufacturing, garment finishing to finishing technologies manufacturing and chemical solutions, excluding the garment manufacturing firms which are analysed through the quantitative analysis.

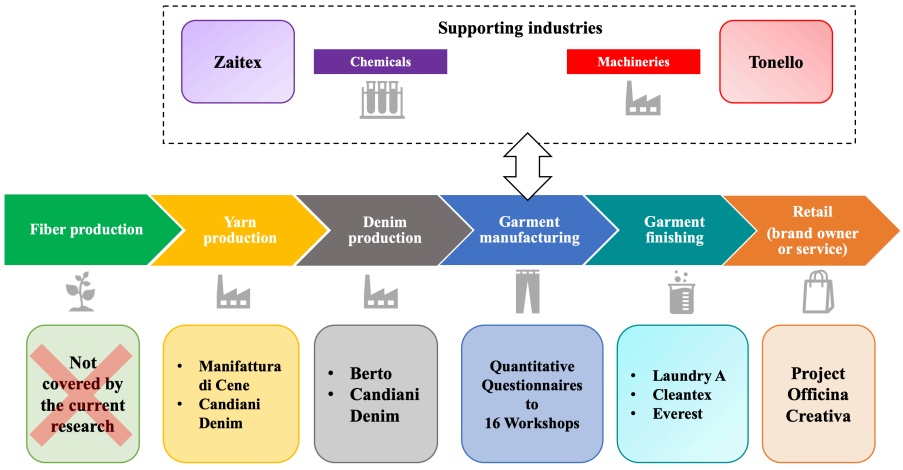
A sample of nine denim suppliers have been selected and contacted, specialized on the different stages of the denim value chain: one yarn producer, two denim manufacturers, three laundries

specialized in denim washing, dyeing and finishing, one garment finishing technology manufacturer, one chemical supplier, and one contractor (service). All the nine companies accepted to collaborate in this research.

The selected firms were identified by the author based on an online research or provided by some interviewed firms, such as in the case of laundries whose contacts have been provided by Project, or as in the case of the yarn manufacturer and of the company producing and providing dyeing and chemical solutions whose contacts have been provided by one of the interviewed firms.

In the *Figure 20* is represented the sample of this analysis and the phase of the value chain the companies belong to. From *Figure 20* emerges that the fiber production phase is not covered in the current research, thus this analysis starts with the phase of yarn production and ends with the garment finishing phase, alongside with the analysis of the supporting industries for the denim value chain, which are Chemical suppliers and Technologies. Moreover the analysis will focus also on a company that is seen as the coordinator of the entire value chain and acts as an intermediary between the brands and the upstream suppliers of the value chain. Therefore, the analysis considers all the upstream suppliers that operate behind the brands.

Figure 20: Representation of the sample selection for the research



source: author's elaboration

The analysed companies are presented in the *table 1:*

- **Manifattura di Cene**: it is a company located in Cene (BG) which is part of the Pezzoli Group, that performs the spinning activity and produces yarns from cotton or other blends such as cotton and polyester mostly for the denim fabric.

- **Berto Industria Tessile**: it is a textile company located in Bovolenta (PD) that is specialized in producing denim fabrics that have from 3 - 5 ounces, therefore very light fabrics, up to 12-15 ounces which are the typical heaviness of the fabric of the jeans. Berto is performing the warping, dyeing, weaving, finishing and quality control activity of the denim fabric.
- **Candiani Denim**: it is a textile company located in Robecchetto con Induno (MI) that produces denim fabrics in different weights, from 7 ounces to 16 ounces and it is specialized in stretch denim and selvedge denim production. Candiani Denim is the largest denim producer in Europe and it is a vertical integrated denim mill which performs the following activities: from spinning, warping, dyeing, to weaving, finishing, and quality control processes.

Table 1: General information of the analysed sample

Company	Sector/ Activity	Province	Clients	Role of Interviewees	Turnover * (2018)	Number of employees
Everest Lavanderie	Laundry and Dyeing	Padua	Diesel, Replay, Acne, Armani, Benetton	General Manager	15.535.818 €	100
Laundry A	Garment finishing	Vicenza	Levis, Fashion Art, Grotto Spa	Owner	6.726.374 €	68
Cleantex	Garment finishing	Vicenza	Bottega Veneta, Valentino, Staff International		771.067 €	8
Berto	Textile weaving	Padua	Diesel, Replay	Marketing Specialist	21.480.318 €	135
Candiani Denim	Textile production (spinning + weaving)	Milan	Hugo Boss, Madeweel, Denham Hallhuber, Dondup	Sustainability Manager	85.357.220 €	582
Manifattura di Cene	Yarn Spinning	Bergamo	Berto	Company Manager	11.322. 404 €	70
Tonello	Garment finishing technologies	Vicenza	Laundries and garment finishing firms	Marketing specialist	33.814.066 €	92
Zaitex	Dyeing and colouring solutions	Vicenza	Everest + other industrial laundries and dyeing companies	Marketing Manager	25.688.366 €	60
Project Officina Creativa	Service	Vicenza	Valentino, Armani, Golden Goose	Owner	3.246.224 €	29

source: author's elaboration

- **Everest**: it is a laundry and dyeing company located in Piombino Dese (PD) that offers a complete range of textile treatments for the finished garments.
- **Laundry A**: it is laundry and dyeing company located in Vicenza that is specialized in dyeing and treatment of finished garments.

* Data retrieved from AIDA.

- **Cleantex**: it is a laundry company located in Sarcedo (VI) that is specialized in the textile treatment of the finished garments made in cotton, mixed-cotton, synthetic, wool and denim.
- **Tonello**: it is the world leader in garment finishing technologies located in Sarcedo (VI) that produces washing and dyeing machines - both from sampling and from production, and technologies for finishing the packaged garment in general.
- **Zaitex**: it is a company located in Povolaro di Dueville (VI) specialized in dyeing and colouring solutions for the textile and leather industry and for other special industries such as wood and plastic.
- **Project Officina creative:** it is a company located in Zanè (VI) that produces denim and sportswear clothes for luxury Brands. Project offers a service to luxury Brands which includes design, prototyping, modeling and the creation of the product totally Made in Italy.

Data collection

The data collection of the quantitative research lasted from September 2019 to December 2019. The questionnaire items have been designed and established on the basis of the information required and needed for the Ghost Maker project combined with the requirements of the topic of this research, which is the sustainability aspect of the garment manufacturers. An online version and a paper version of the questionnaire was created. The way in which the items are presented may affect the responses obtained. Therefore, the author designed the items of the questionnaire in a clear manner by using a technical language typical of the sector and avoiding complex and unfamiliar terms, in order to increase the response rate and the reliability of the answers. Once the questionnaire was defined, the author tested it for content validity by referring it to the target respondents, to provide feedback on issues that could affect the responses or on items that could be improved. The target respondents consisted in three denim manufacturing workshops who represent the Project Officina Creativa's suppliers, and who were contacted by e-mail to ask for their cooperation and compilation of the online questionnaire. The contacts of these respondents have been provided by Project. On the basis of their feedback, the questionnaire was improved and the final version was established.

Once the final version was defined, Project Officina Creativa met the Cucirini Rama's agents, who are responsible of questionnaire administration, in order to explain them the questionnaire items and the research project. The respondents of the questionnaire have been approached directly by the agents, while visiting them, by explaining them the aim of the project and by leaving them a copy of the questionnaire to be filled, asking them to complete it. By approaching directly the respondents by agents that are part of the industry increases the

probability of avoiding the non-responding companies, hence improving the response rate. The questionnaire was left to the respondents for a month and after this period of time, the agents visited again the respondents to withdraw the answers. The quantitative questionnaire includes different types of questions (see Appendix 2): multiple-choice questions, open questions and Likert-scale questions. The questionnaire is divided in two parts: the first part containing the "General information, markets, customers and technologies" and the second part which relates to "Brand Audit and corporate responsibility". However, among the 30 administrated questionnaires, only 18 workshops answered it, hence the response rate is not that high.

The data collection of the qualitative research lasted from October 2019 to December 2019. The questions of the interview were defined on the basis of the literature and on the basis of the position in the value chain. Before defining the interview, the website, if available, was consulted in order to understand the company's activity and to establish the content of the interview. Once the interview was defined, the author started to contact the identified firms mostly by phone or by e-mail by explaining them the aim of the research and the topics to be discussed, asking for their availability for the interview. Most of the times, before the interview a copy the interview have been sent to them by e-mail. The majority of the interviews were held by phone and only one interview was held by e-mail. Respondents were owners, managers, marketing specialist and sustainability managers. As the interviews are conducted in a semi-structured manner, recording devices are used to not miss the opportunity for a thorough registration and transcription of the answers. Nevertheless all the respondents have been notified about this.

The interviews are held in a semi-structured way, with the order of questions being quite the same. However, the questions were different between the respondents belonging to different stages of the value chain, according to their firm's specialization and position in the value chain. Semi-structured interviews are more suitable for explorative studies, however the author wants to be able to compare the answers within the same stakeholder group. By doing this, it enables an easier comparison between the answers from different interviews. The response options are open, as this allows for the respondents to be more open in their expressions of values, attitudes and thoughts. In addition to the interviews, secondary data was collected from the firm's websites if available and other sources, such as the Sustainability reports. The secondary data will be integrated with the results of the interviews, in order to have a broader view about the findings of the study.

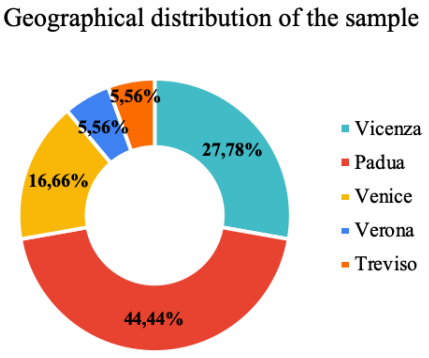
CHAPTER 5 – EMPIRICAL ANALYSIS: FINDINGS AND DISCUSSION

5.1 The quantitative analysis: the garment manufacturing phase

The quantitative analysis is performed on garment manufacturing workshops located in the Veneto area. The analysis was carried out based on The Ghost Makers project whose aim is to make visible the know-how, capacity and the sustainable performance of the small workshops involved in the manufacturing of denim garments. The **total sample is made of 18 firms**.

All the analysed firms are located in the Region of Veneto; the majority of firms (44%) are from the Province of Padua, following Vicenza with 28%, Venice with 17% and Verona and Treviso with only one firm which represents 5,6% from the total of 18 firms. Regarding the year of establishment, 56 % of firms have been established between the 80s – 90s, which is in line with the period of the development of the so called "Denim district" in Veneto area. The reference market for the majority (83%) of firms is, in fact, represented mainly by the clients located in the Veneto area. All the interviewed firms are *small companies*, with a number of employees ranging between 3 and 35 employees and, in the majority of cases, with the annual turnover (2018) not above the 1 million Euro. Only three firms had in 2018 a turnover that exceeds the 1 million Euro, however it was not above the 10 million Euros which is the limit to identify the company as a small one. Whereas, two firms have not answered the question relating to the annual turnover.

Figure 21: The Geographical distribution of the sample

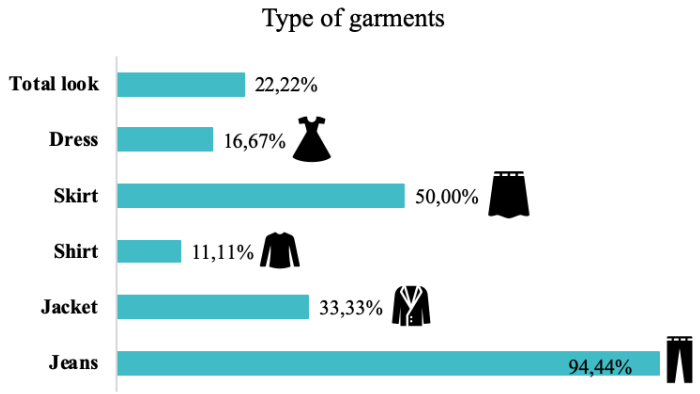


source: author's elaboration

The denim garments manufactured by the workshops on behalf of brands include *jeans, dresses, skirts, denim jackets, shirts and total denim looks (include all the types of denim garments)*. As shown in the *Figure 22*, all the surveyed workshops are specialized on sewing jeans, and half of them are also specialized on sewing skirts. The 33% of surveyed workshops are also manufacturing denim jackets and quite 17% - also denim dresses. However, just the 11% of

them are sewing denim shirts and the 22% are manufacturing total denim looks, which implies that they manufacture every type of denim garments, from jeans to shirts, jackets, and dresses.

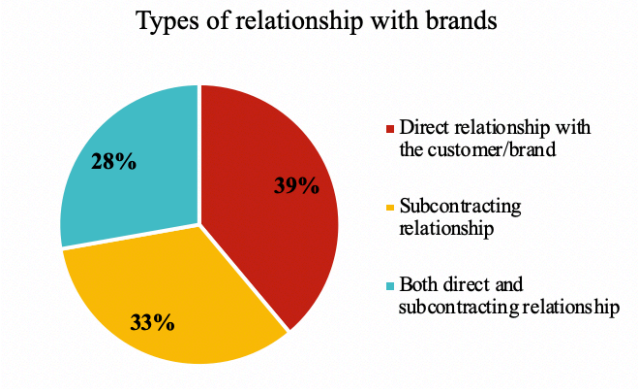
Figure 22: Type of products manufactured by the workshops



source: author's elaboration

All these companies work on behalf of brands or contractors and do not own any proprietary brands. Indeed, the 39% of the surveyed firms are establishing a direct relationship with their clients or brands as shown in the (*Figure 23)* and the 33% establishes subcontracting relationships. Nevertheless, there are 28% of firms that are engaged in both direct and subcontracting relationships with their clients. This structure shows the characteristic of the Italian fashion system presented in the chapter 1, in which there are several small workshops that produce for fashion brands directly or through the intermediation of a contractor that commission the collection of brands. Among their clients and brands there are: Diesel; Replay; Staff International which owns brands such as Dsquared2, Maison Margiella; Giada Spa with the Jacob Cohen brand; Fashion Art that produce for Chanel, Chloè, etc. Therefore, all their clients are belonging to the premium and luxury segment market.

Figure 23: Types of relationship with the Brands



source: author's elaboration

The reason why the premium brands are choosing the small workshops for their clothes manufacturing are related to Made in Italy craftmanship, high quality products, know-how and

flexibility. The analysis identifies that the interviewed firms ranked[11] the "*quality of their products*" as the main competitive advantage factor for them, followed by *"production flexibility",* "*customers service*", *"distinctive skills"*, "*employees training*" and *"social responsibility"*. However, the lowest points have been attributed to the "cost reduction" and "product innovation" factors. Therefore, this implies that the interviewed firms distinguish for the high quality, skills, flexibility and social responsibility, that are exactly the elements that the premium brands are searching for.

5.1.1 The approaches to sustainability

When analyzing the sustainability practices implemented by the garment manufacturing workshops, it is relevant to take into account the activities carried out by them. Most of the workshops part of the sample are performing only the sewing and manufacturing activities, and just a minimum part of them execute further activities such as prototyping, ironing and application of various accessories. The activities developed by the denim garment manufacturers have a minimum impact on environment, as they are not employing any water and energy intensive technologies, and any wet processes. However, the social aspect of sustainability is becoming relevant, as the workshops have to pay attention to their employees' wellbeing, to provide safe working environments, to respect the standards imposed by their clients and the regulation imposed by the governments. Therefore, for the reasons listed above, this analysis focuses more on the social sustainability practices of firms rather than on environmental sustainability, as the social sustainability is the main concern in this phase of the denim value chain. Among the surveyed workshops, **only one company** out of the total sample, is not taking into account the social responsibility while carrying out its business. Therefore, the majority of them are taking a social responsible behavior while performing their activities.
In order to establish the sustainability performance of the workshops, the administrated survey included a question where the companies were asked to rank some listed sustainability activities on a scale from **1 (not at all)** to **5 (a lot)** based on whether they perform them or not. If an activity was not entering into the expertise of the company, then it had the possibility to choose also the "**Not of competence of the company**" choice. The activities included into the survey are the following and were based on the analysis of literature, national regulation and Brand's Code of conduct:

- Training activities aimed at employee development in addition to those required by legislative obligation;

[11] The ranking was defined by calculating the average of the points (on a scale of "1- not at all to 5 - a lot") given by all the companies.

- Activities and/or procedures aimed at increasing the level of hygiene, health and safety in the workplace;
- Training courses on employee health and safety;
- Policies that ensure benefits or company services to employees;
- Action plan for equal opportunities;
- Drafting of the Risk Assessment Document;
- Possession of the Certificate of fire prevention and/or Certified Start of Business Report;
- Possession of the certification of the maintenance of the fire prevention systems (fire extinguishers, smoke detectors, etc.)
- Certification of conformity of the electrical system;
- Implementation of an Ethical Code;
- Reduction of the use of resources (water, energy, raw materials);
- Prevention of waste production and reduction of waste;
- Registration to the Control system of waste traceability;
- Education and training of employees for the respect for the environment.

The maximum points a company can obtain, by ranking all the activities, are **70 points**; the answer "Not of competence of the company" is assigned with zero points.
Based on the results, the author divided the sustainability performance into three categories. The interval of each category have been established based on an analysis of the interquartile range as represented in the *Table 2*. So the first category is corresponding to the first quartile (0 – 30 points), the second category is corresponding to the interquartile range (31- 53 points), whereas the third one is corresponding to the values above the third quartile (54 -70 points).

Table 2: Analysis of the range of the results; values expressed in points

Range	Values
Maximum	63
Third Quartile	53,75
Median	41,50
First Quartile	30,25
Minimum	0
Average	39,22

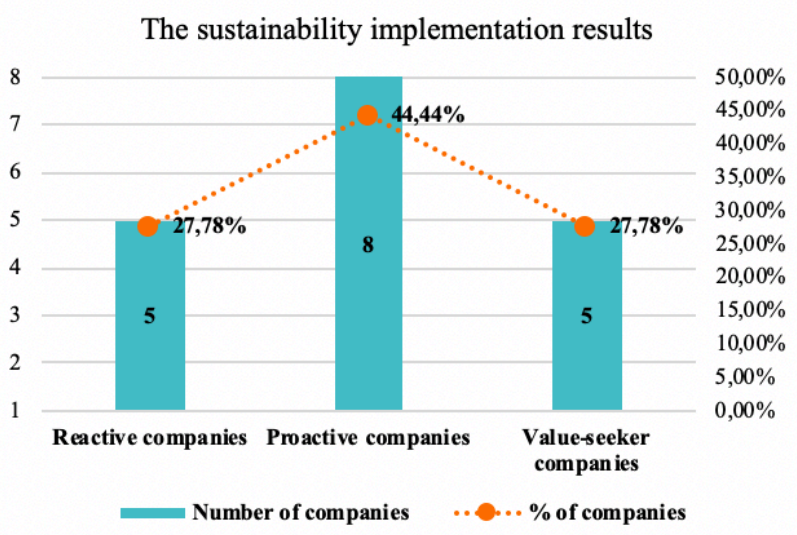
source: author's elaboration

- from *0 to 30 points* is "**Low/poor implementation"** which corresponds to **reactive workshops** and implies that the companies are complying only with the minimum sustainability requirements imposed by the standards and regulations.

- From *31 to 53 points* is the "**Medium implementation**", which corresponds to **proactive companies** and implies that the company complies with the standards beyond those imposed by law. Therefore, these companies are concerned about their employees and the social impact of its activities. However they have to improve further their performance.
- From *54 to 70 points* is "**Outstanding implementation**" typical of **value-seeker companies**. The companies from this category are the best in class and the sustainability is part of their strategy.

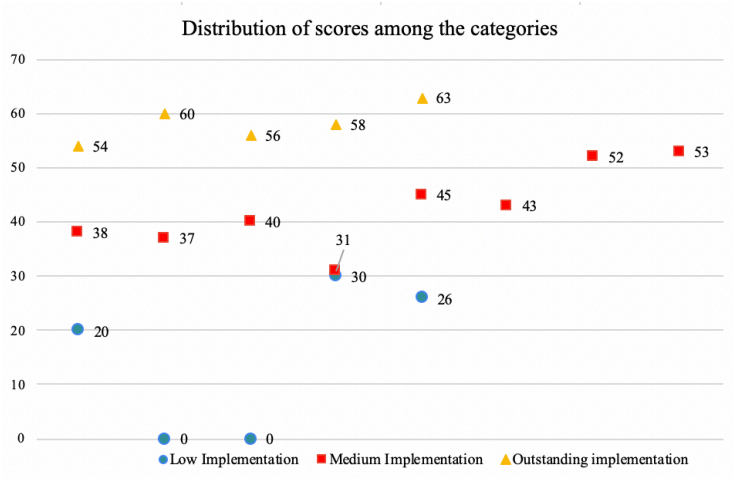
The results achieved by each workshop and their distribution are represented in the *Figure 25*.

Figure 24: The allocation of the scores among the companies



source: Authors's elaboration

Figure 25: The distribution of scores among the categories



source: author's elaboration

As represented in *Figure 24*, the sustainability performance of surveyed firms is quite homogeneously distributed among the three categories. The highest percentage of surveyed companies (44,44%) is made from proactive companies which manifest a medium implementation of sustainability practices. The low and outstanding implementation categories are symmetrically allocated among the remaining companies. This implies that five out of the 18 surveyed companies are reactive workshops and the other five are the best in class companies.

By analyzing the ***low implementation*** sample of reactive companies, could be observed that two companies out of five scored zero points; this implies that all the answers of these two companies were "Not of competence of the company". This type of answers does not automatically mean that the company's activities do not include none of those listed in the survey; it could be also related to the unwillingness of these companies to provide information or to the low motivation to answer the questions. Thus, even if their scores are associated with low implementation, it could be that the real level of implementation of sustainability practices is a different one. By analyzing the remaining three companies of the *reactive companies* sample, it is possible to identify the tendency of these companies to perform the minimum requirements imposed by law or by brands. They provide training to their employee in the field of health and safety and possess some of the certifications or documents required by law or imposed by the brand audits, such as the Risk Assessment Document, certification of the maintenance of the fire prevention systems and the certification of conformity of the electrical system. Indeed, among the drivers that push for a sustainable behavior indicated by these companies are the *need to align with the demands of existing legislation* and to *respond to the requests from customers or clients*. Although all these companies stated that they are taking into account the sustainability aspect while performing their operations, the results show that their approach is more a *reactive* one and their efforts are not enough. From the analysis results that *the lack of financial resources and time* and the *lack of internal company skills on social responsibility issues* hinder the implementation of a sustainability approach within the company and the improvement of sustainability performance.

The ***medium implementation*** group includes eight companies out of the total of 18. These proactive companies tend to enhance the safety and wellbeing of their workers by performing activities aimed at increasing the level of hygiene, health and safety in the workplace. In addition to this, they provide employees with continuous training regarding the safety issues that could rise in the working environment. They are also complying with all the requests for documents: for instance the Risk Assessment Document; certificate of fire prevention and/or

Certified Start of Business Report; certification of the maintenance of the fire prevention systems (and the certification of conformity of the electrical system. Unlike the low performance companies, the medium performance ones are performing some activities related to environmental sustainability, although the score attributed to them is not the highest one. Some of them are trying to reduce the use of resources (water, energy, raw materials), to reduce the creation of production waste and to train their employees towards the respect of the environment. Among the drivers identified for this sample, besides the need to answer to the requests coming from the clients or imposed by the regulation, is the opportunity *to improve the competitive position of the company into the existing market*. The company that stated that is not taking into account the sustainability aspect while carrying out its business results to be part of the *medium performance* category and achieved a score of 43 points. Therefore, even if this company does not intend to perform its business activities with a sustainability approach in mind, it is able to achieve a medium performance as well. The main difficulty to the implementation of a corporate responsibility policy outlined by this company was the *lack of financial resources and time* to dedicate to sustainability within the company.

The ***outstanding sustainability implementation*** group includes five companies out of 18 and the highest score achieved was 63 out of the total of 70 points. Firms belonging to this category are considered as value-seeker, thus they are paying a special and dedicated attention towards the health, safety and wellbeing of their employees. Indeed, most of them are providing training activities aimed at employee development in addition to those required by the legislative obligation and are carrying on activities directed at increasing the level of hygiene, health and safety in the workplace. Furthermore, these companies are putting in place policies that ensure additional benefits and company services to their employees. An activity performed by the companies in this category which differentiates them from the companies in the other two categories is the implementation of an Ethical Code and the implementation of an action plan of equal opportunities. Compared to proactive companies, the value-seeker companies are attributing higher importance to the environmental issues and therefore the score assigned to these activities is higher. Among the drivers that stimulate the company to behave in a sustainable way emerges, in addition to those listed for the other two categories, the *ethical reasons and consistency with the company's vision*, *the possibility to increase the value of the products offered* and to satisfy *the requests from trade unions attentive to sustainability issues.* However, also for this group of companies, the lack of economic resources and time to devote to the implementation of sustainability practices within the company are identified as the most important barrier.

5.1.2 Traceability within the garment manufacturing phase

The *traceability* in the garments manufacturing phase can be deemed as very poor. Indeed, the majority of surveyed companies is not able to trace its products neither internally nor externally. They do not employ any technological tools which can allow at least the internal traceability of the products. Only two companies out of 18 are owning tools, such as Remote control and Personal computer integrated with the electronic machine control units, that allow the internal traceability of products they manufacture. However, four companies have an integrated software with their clients, thus allowing their clients to trace, in some way, the activities and the progress of the manufactured garments. The poor traceability within this stage of the denim value chain could depend on the small size of the companies which often results in a workshop structure, limited financial resources and the characteristics of the sewing activities which require limited investments in technologies, thus companies have a limited technology capacity.

The limited technology capacity of the surveyed garment manufacturers is highlighted also by the scarce adoption of ICT technologies. The majority of the workshops are employing just a personal computer, an e-mail and an administration software. However, only three companies out of 18 have a website, through which they can make themselves known and visible to the international brands. Furthermore, only two workshops out of 18 own social platforms such as Facebook, Instagram or LinkedIn in order to communicate what the company is doing and to increase their visibility. This is in line with the assumptions of the Ghost Makers Project, which outlines that the Italian workshops are very good at making fashion, but most of the times they are invisible to the market. Thus the Ghost Makers aims at providing them the opportunity to become visible to the market without spending time and investing in a website or in advertising.

5.1.3 The effect of Brand audits on analysed companies

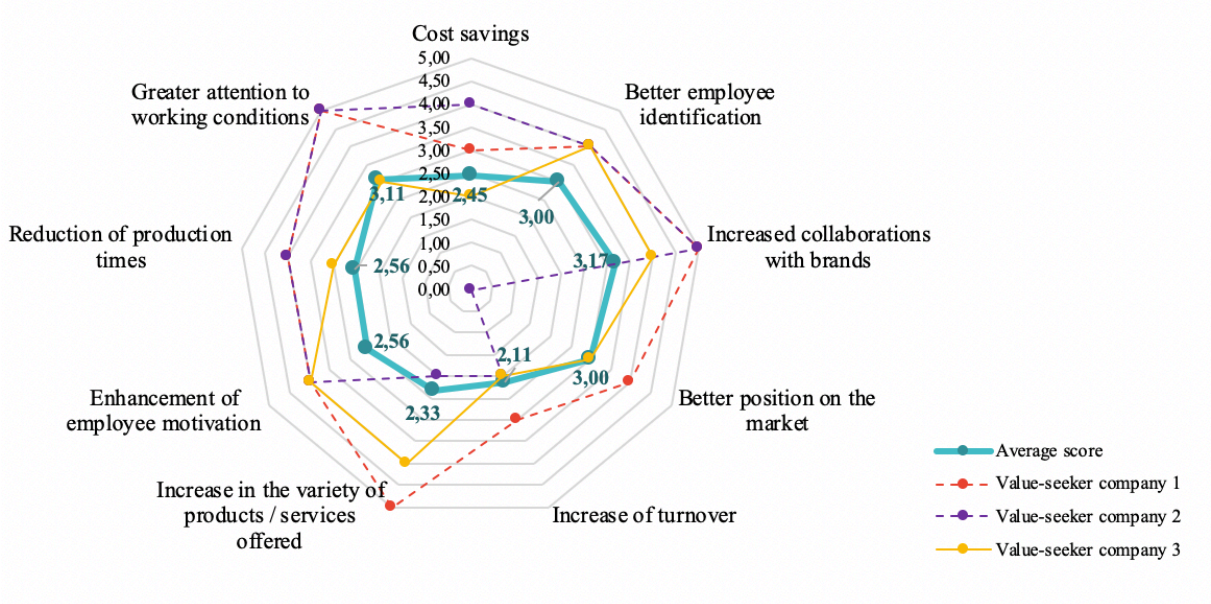
Since the majority of fashion brands are not performing internally their clothing manufacturing and outsource it to small workshops, usually they tend to monitor their activities by submitting them an audit, which has the aim to control the compliance of the companies with the standards and its documentations which attest the regular activity of the company. Among the surveyed companies, only three of them have not submitted an audit from their clients. The high number of companies representing the 83% of the surveyed companies that undergone an audit from the brands, shows that audits are quite a normal practice in this phase of the value chain.

In order to determine whether the audits influenced the companies' operational activity or not, the survey provided a question dedicated to this which had to be answered only by the firms

that have submitted an audit by their clients. The question provided some potential consequences resulting from an audit which had to be ranked by the surveyed companies on a scale from **1 (not at all)** to **5 (a lot)** based on whether the brand audit influenced it or not. If an activity was not entering into the expertise of the company, then it had the possibility to choose also the "**Not of competence of the company**" choice. The average results of the potential benefits are represented in the *Figure 26*. As can be noticed, the average results are around two or three points so they are quite far from the maximum of five points. The four highest score have been assigned to the "*Increased collaboration with brands*" with 3.17 points, *"Greater attention to working conditions*" which scored an average of 3.11 points and "*Better employee identification*" and "*Better position in the market*" obtained an average score of 3 points each.
These results reveal that as a consequence of an audit undergone by a company, the company may start to pay greater attention to working conditions of their workers. Since many of the brand audits focus on the social aspects and on workplace conditions and safety, companies may start to give more importance to them and to improve their performance in order to comply with the standards required by the audits. As a consequence, employees may feel more identified with the company, thanks to the attention dedicated for their wellbeing. Moreover, by improving their working conditions and operating according to the imposed principles, the companies may increase the number of collaboration with luxury brands and to improve their position on the market, as brands are always searching for workshops that can provide high-quality products and at the same time behaving in a sustainable way.
The remaining potential effects of audits obtained an average score under the three points, thus they are not that relevant for the companies. From the analysis results that brand audits are not leading to "*Cost savings*" due to improved production process efficiency and staff training and do not entail an "*Increase in annual turnover*" compared to the a period before the audit. Furthermore, it seems that the "*employee motivation*" is not enhanced and there is no a "*reduction of production times"* thanks to the employee training and improvement of working conditions.
By looking only at the average scores of the effects of a brand audit on the company's operations, it is possible to claim that *the audits are not influencing at a high level the way the companies are performing their business*. This statement is in line with what outlined by the literature. LeBaron et al. (2017) claim that retailers and brands use audit programs in a way that legitimate and protect their business interests, rather than actually addressing social and environmental problems within their value chain. In this way they create the illusion of an effective value chain governance. However, the result may be influenced by the country where the companies are located. As the surveyed companies are located in Italy, where predominate

already stringent regulations and standards and where the majority of them comply at least with the minimum standards imposed by the law, it could be that the policies imposed by the audits and the documents requested during audits are already implemented by them, hence the audits are not influencing in some way their activities. Another possible explanation could be that the reactive companies, which are those that assigned the lowest score and influence the average results, are implementing just the minimal requirements of the audits, thus their activity is not influenced too much by the brand audit.

Figure 26: The Average Score attributed by the surveyed companies to the potential impacts of a brand audit compared with the Top 3 value-seeker companies' scores



source: author's elaboration based on the results of the survey

For this reason, the author decided to compare the average results with the scores attributed by the value-seeker companies, in order to understand whether the brand audits had an influence on the operations followed by the value-seeker companies, given that these companies are those that implement all the activities and practices related to social and environmental sustainability. Therefore, the scores of the Top 3 value-seeker companies have been compared with the average scores provided by the surveyed companies. As can be observed from the *Figure 26*, the points assigned by the three top companies are much higher than the average scores. In particular, the Top value-seeker company (represented into the Figure 26 as company 1) attributed the maximum points to the majority of the factors. This implies that after the brand audits, this company started to pay greater attention to working conditions, increased the variety of products offered, improved the position on the market and increased the collaboration with brands. The activities of the second top value-seeker company (represented into the Figure 26

as company 2) which have been the most influenced by the audits regard the attention to working conditions, increased collaboration with brands, cost savings and reduction of production times. The last value-seeker company (represented into the Figure 26 as company 3), instead, was quite close to the average values. This implies that the audits influenced the activities in a moderate manner, compared to the other two value-seeker companies.

Based on this analysis, it can be concluded that the brand audit is a normal practice within the garment manufacturing phase of the value chain. At a general level, it seems that audits are influencing in a moderate way the activities of the analysed companies. However, the effects of the audits are perceived differently by the workshops, depending on the level of implementation and the type of sustainable activities within the company. This implies that the effects are in some way correlated to the level of implementation of sustainability practices. While for the reactive companies which are characterized by a poor implementation of sustainable practices, the audits are not influencing in a positive way the activities of the company; for the best in class companies, the audits have a positive effect on the company's operations and activities, helping to increase the collaboration with brands, improving further the working conditions, reducing production time and costs, and increasing employee motivation.

5.1.4 Implications for the Ghost Makers Project

Based on the results emerging from the quantitative analysis, it is possible to identify the companies that are suitable to participate at the Ghost Makers project. As the requirements of the project for the companies being part of it are to respect the ethical principles of social responsibility, the current regulations and the chemical safety requirements (Progetto Filiera Fantasma, 2019), the identified *proactive and value-seeker workshops are those that respect these requirements, thus are appropriate to be part of the project*. These workshops can provide to brands, in addition to unique skills and capabilities, also an internal commitment to and the implementation of sustainability practices, by incorporating sustainability into the manufactured products. The total number of proactive and value-seeker companies identified is 13 out of 18; this implies that, although their small size, the majority of Italian workshops are already adopting sustainable principles and are able to satisfy the demand for social sustainability coming from the market. Being part of the project both proactive and value-seeker workshops, the networking effect and the sharing and spreading of values and information may motivate the proactive companies to improve their implementation level and to become a value-seeker company. Moreover, by being part of the project, the proactive and value-seeker

workshops can have a competitive advantage over their reactive competitors, and to obtain a better payment for their excellent work.

5.2 The qualitative analysis of the denim value chain

The aim of the following paragraph is to investigate and analyse the approaches of the Italian companies part of the denim value chain to sustainability, both in environmental and social terms, in order to evaluate the pressures in the industry, the drivers, the barriers and how companies integrate sustainability in their strategy. Moreover, in order to investigate the entire value chain, traceability and transparency of the value chain are analysed. The research will follow the order of the activities in the value chain, hence it starts with the yarn and denim fabric production, going through the garment finishing, supporting industries and ending up with the coordinator of the value chain. The fiber production phase of the value chain is not covered by the current research, though by investigating the yarn and denim production phases also the fiber production will be touched. Each company is investigated individually, then a cross-case analysis is carried out for the firms performing the same activities or operating in the same phase of the value chain. Finally a global analysis of the entire value chain is developed, in order to understand the sustainability state of the Italian denim value chain and to evaluate its traceability and transparency, on the basis of the dimensions analyzed during the interviews: dominant drivers, implemented environmental and social practices, perceived benefits, challenges, demonstrated approach towards sustainability, traceability and transparency, and role of technology.

5.2.1 Yarn and denim production

5.2.1.1 Manifattura di Cene

The Qualitative Research concerning *Manifattura di Cene* has been done through an interview and discussion with the *Manager* of the company, which manages the entire production processes within the company (*see the questions in Appendix 3*).

Manifattura di Cene is covering only the spinning phase of the value chain, by producing mostly cotton yarns or yarns made of blends such as cotton and polyester for the denim fabrics. Although, historically the company was specialized in producing yarns only for denim, nowadays, given the downturn of the Italian denim industry, the company has decided to switch its production and to produce alongside yarns for denim, also yarns for other types of fabric. The company is located in Cene (BG) in the Lombardy area and it is part of the Pezzoli Group which owns other companies specialized in spinning, weaving, manufacturing, embroidery and product finishing. Manifattura di Cene offers its products only to Italian customers which are

textile companies that perform the weaving activities and transform yarns into fabrics. One of its clients is Berto, who is also part of this research.

Environmental and social sustainable practices

Although the company is not following a defined sustainability management strategy and not always its activities are originally thought within the lens of sustainability, it tries to reduce its environmental and social impact. With regard to the social responsibility, the company tries to provide good working conditions and healthy environments for its workers. During all the activities performed in the spinning phase such as fiber cleaning and blending, carding and spinning, an high quantity of dust is created, which can affect the workers' health and wellbeing. To avoid these issues and to create a good working environment, Manifattura di Cene is continuously cleaning the air within the plant by using a conditioner that removes the dust and the micro dust from the area by providing always fresh air. Furthermore, the company has a dedicated office which deals with the safety of workers and prevention of workplace accidents and guarantees the safe working conditions.

The environmental impacts attributed to Manifattura di Cene's activities in general can be associated mostly to the use of energy, CO_2 emissions and creation of waste. The spinning activities are, in fact, energy intensive, which consequently results in high CO_2 emissions. Moreover, along the activities of yarn production, high amount of fiber waste and by-products are created. However, the company performs several activities that reduces its environmental impact. The company is using the energy produced by its hydroelectric power plant, hence it uses renewable energy sources and it is energetically independent. The adoption of modern technology is supporting the company to become more sustainable, although it is introduced not with the sustainability aim in mind, but with the purpose to become more efficient. By introducing modern technologies and replacing the old ones, the company became more efficient and faster in producing the same quantity of product with less manual labour and less energy. The new machines are performing the activities in an automatically manner and the operator mostly controls the operations. In this way, the current machines are also improving the worker's wellbeing, since they are performing less manual and heavy labour. Compared to the old machines that always run even when they were waiting for the other machines, these current machines, instead, stop when they have finished their operation, hence representing high energy savings for the company and consequently less CO_2 emissions.
Concerning the fiber waste, Manifattura di Cene is recycling internally the cotton lost during cleaning, blending, carding and spinning activities, which is recovered into the production

process by a specific machine. In this way the company is recuperating valuable resources (short fiber) which otherwise would result in economic losses, and at the same time it is reducing considerably the creation of fiber waste and its disposal into the environment. The only waste created by the company is made of shells and impurities which cannot be used in the production and they are given to farmers, as the latter use them for the bedding of cows.

As the company does not perform any wet activity, it is almost not wasting water. The only use of water by the company is associated to the conditioning system and to the plants that are nebulizing the water to maintain constant the humidity of 52% - 53%, necessary for the conservation of cotton. However, the water is always recycled which implies that the water that is not nebulized falls dawn, it is collected in a large tank and reused again.

Sustainable supply chain management

The sourcing decision of the company is driven mostly by quality of products which then has an impact on the efficiency of the company. The criteria used to select suppliers of raw materials, such as cotton, is to choose the supplier that provides the cleanest cotton, in order to reduce the amount of cotton discarded in the cleaning phase, thus to reduce the amount of waste and the loss of raw materials. Hence, in some way the used criteria has also an indirect implication on environmental sustainability of the company. The company manager states that "*Now we buy no longer African cotton, but almost everything is American cotton, where it is harvested with machines and no longer by hand (the African is still picked by hand). It is not that the African cotton is not beautiful, but to us it meant a big waste because by collecting it by hands, inside, there were some pollutions*". By harvesting the cotton by hand, several impurities and pollutions get inside, thus in the cleaning phase a high quantity of cotton is discarded as it is considered not suitable for production. The company employs different types of cotton fibres: conventional cotton, organic cotton and recycled cotton which is blended with other fibers such as polyester, Tencel and Viscose. However, it is not able to trace its productive inputs, except the organic cotton, neither its products and processes, because it has not a system that allows the traceability of these information.

Drivers

Concerning the pressure or drivers in the industry for sustainability, it seems that *Manifattura di Cene* has not felt any pressure from its customers, brands and the market, and the sustainable practices developed by the company are *voluntarily* implemented based on the legal requirements or pushed by the availability of new technology and the need of the company to

save its resources. As highlighted by the literature (Ditty et al., 2019b), being its activities at the very beginning of the value chain, brands may not have any direct contact with them and may lack visibility in the value chain. Therefore, this shows that the drivers from brands or market for sustainability are not perceived in the upper phases of the value chain. This is also confirmed by the fact that the company has not received any audit from its clients or brands. From this analysis it could be deduced that the audits from brands are stopping at the weaving phase, hence at the denim production phase. As suggested by the literature (LeBaron et al., 2017), many fashion brands are auditing only their first-tier suppliers and maybe expect these suppliers to audit their sub-suppliers down the chain. However, most of these first-tier suppliers are not conducting any audit of their suppliers. The same is emerging from the reasearch, which shows that Manifattura di Cene which is a yarn producer was not receiving any audit from brands or clients.

5.2.1.2 Berto Industria Tessile

The Qualitative Research concerning *Berto Industria Tessile* has been done through an interview with the *Marketing Specialist* of the company, which has an important role in communicating the sustainability practices implemented by the company (*see questions in Appendix 3*).

Berto Industria Tessile is a textile company founded in 1887 in Bovolenta (PD) which at the beginning was producing sails for the boats of Venetian Republic. Then the company was traveling in many textile sectors; from home textiles, fabrics for workwear, tablecloth and finally specializing in denim, which represents the current business of the company. The company is producing denim fabrics that have from 3-5 ounces, therefore very light fabrics for shirt fabrics, up to 10-12-15 ounces which are the typical heaviness of the fabric of the jeans. The production process starts with the purchase of cotton yarns (or other type of yarns) which then makes their way through the *warping, dyeing, weaving, finishing and quality control activity* of the denim fabric. The company is located in the province of Padua, thus is part of the so called the "Denim district of Veneto" which is characterized by innovation, research and the ability to follow the evolution of the market as well as the respect of territory and tradition. Berto is selling its products in the Italian market to brands such as Diesel, Replay, etc. as well as in other European countries to brands such as Benzak Denim Developer and others.

As the activities performed by the company include warping, dyeing, weaving, finishing, in general they are energy and water intensive and as a consequence produce high amount of emissions, textile waste and wastewater. Moreover, during the dyeing and finishing process

several chemical agents are used that may have an impact on workers that work with them and create toxic wastewater. From the interview with the Marketing Specialist of Berto, emerges that the company is committed to sustainability and pays great attention to the environment, employees and society.

Figure 27: Berto Industria Tessile

source: http://www.berto.it/site/it/produzione/

Environmental and social sustainable practices

Although currently, the company has not an environmental and social sustainability management strategy, it is structuring itself to implement it in the near future. The new technology and the research and innovation in the chemical and dyeing industry performed by Berto, help the company to follow this path. The company employs high energy efficient frames for the weaving of the denim fabric which perform better, thus reduce textile waste and require less energy for the same performances, and consequently produce less CO_2 emissions. Moreover, to reduce the energy consumption, the luminous body of the weaving part of the plant was substituted with LED. Nevertheless, the company is energy independent by using renewable energy deriving from the solar panels.

The company performs the dyeing activity of the denim yarns with indigo; the yarn is dyed in a continuous dye that uses the water tanks in which the indigo and chemical agents are inserted. In order to reduce its environmental footprint, the company uses pre-reduced indigo which requires less chemical agents and less dyeing tanks to obtain the same intense blue denim colour. Therefore, at the same time, the use of pre-reduced indigo allows to save high quantities of water and to reduce the waste water. Furthermore the company has an internal water treatment plant which treats and cleans the waste water resulting from the wet processes. The purifier cleans biologically the water, which returns pure water (Class A) and then the cleaned water is returned again into the river, whereas the sludges resulting from this process are used as fertilizers in agriculture. By using the water from the river in its processes and returning it

again into the river, the company is in some way doing a recycle of the water used into its production processes.
In the fabric finishing phase, Berto invested in an innovative machine that works with Ozone and which saves the 80% of water, hence reducing also the levels of CO_2 emissions by 30% and the quantity of waste water. Moreover all the chemical agents and dyes used by the company in the dyeing and finishing phases of the denim fabric are approved by the DETOX commitment and REACH, hence this implies that the used substances are not harmful for the employees and final customers. In order to prove this, the company engages an laboratory which periodically conducts an analysis of its waste water. The company possesses several certification and standards such as OEKO-TEX standard 100, GOTS and GRS certification and follow the REACH Protocol which guarantee that the inputs used are not harmful and respect the imposed standards.

With regard to social responsibility, Berto provides safe workplace and standards for its workers. An innovative conditioning system was introduced in order to clean the fluff deriving from the warping and weaving activities, and to reduce the breath issues for the workers. The standards and the certifications owned by the company further ensure the protection of the workers within the company, due to the avoidance of hazardous chemicals from the production process. The company follows the ISO 9001 standard and operates according to the specific standards imposed by the certification in order to guarantee the safety and wellbeing of workers into the workplace and to prevent work accidents.

Sustainable supply chain management

The sourcing decision of the company is influenced by the demand of the brands. Berto produces denim from conventional cotton as well as from BCI cotton and organic cotton. Even if the literature highlights as a sustainable practice the substitution of conventional cotton with organic and BCI cotton, the demand for organic cotton and BCI from Berto's clients is still too low (around 5% - 10%), although in the last period it is growing. It is also using recycled cotton yarns, resulting from its production waste. Marchi & Fildi, one of its suppliers, are producing this regenerative cotton yarn, of which the 65% of cotton comes from Berto's by-products of the indigo dyeing. By recycling their textile waste and by using this type of yarn, the pre-industrial waste is reduced and reused, less new inputs (cotton, water to grow cotton, energy, chemicals and indigo dyes) are employed. Although the regeneration of textile waste was thought at a production level with the aim to recover the production losses, it represents the first

step of the company to become more circular. Indeed, the company starts to think further in a more circular way and to design its products for reuse or recycling at the end of their life.

The interview reveals that Berto has been submitted to several audits from their clients. The audits imply both a qualitative specification regarding the products they provide and a social specification regarding the human resource management, social and safety standards and employees wellbeing. However, the audits are not influencing the company's operations and activities. This is connected to the fact that unlike the suppliers located in developing countries, Italian suppliers are following rigid rules and standards imposed by the national Government, so they are already following the standards that are requested by the audits. "*Because we have always produced in Italy, we have always respected certain rules, which are also those that our State and our law impose on us*" states the interviewee.

Traceability and transparency

With regard to traceability, the company owns a Supply chain management system, which allows to trace internally its products and processes, from the first production phase up to warehouse, thus providing customers with updated information regarding their orders. Furthermore, this system, by providing process data, enables to perform product life-cycle management of the semi-finished and finished products and to trace and measure the CO_2 emissions and the use of water. In this way, the company is able to provide to customers all the relevant information with regard to the savings and the reduction in environmental and social load associated with its denim. Hence, in an indirect way, its clients are able to trace the supplier of denim and the sustainability issues associated with the denim production. And its clients and brands can use this information with a transparency scope and to show their commitment to sustainability. As the Marketing Specialist of Berto outlines the continuous investments in innovation and technology and the savings obtained give "… *the possibility of telling the customer how the fabric bought from Berto respects certain standards and uses fewer resources compared to another fabric or a fabric that we produced differently in the past*." However, when it comes to communication by brands of the sustainability practices performed by Berto, the brands communicate it only in the case of "ingredient branding and co-branding projects", although in a very essential way.

Drivers and barriers

As a driving force that pushes Berto to engage with environmental and social sustainability could be considered both willingness of the company to be responsible as well as the requests

from its clients and market. The most important driver is the willingness of management to carry on the corporate values that have always guided the Berto family. The company is still a family-run business and among its values there is the respect for the environment and for the employees who work for the company, in some case for several generations. Therefore, sustainability is considered a shared value within the company and regards all the activities of the company: from raw material sourcing, to the optimization of production processes, to training and protection of employees. The external drivers are associated to the frequent customer requests, which sometimes are very confusing and different. The Marketing specialist, in fact, states that the certifications possessed by the company are used as guarantees for the customers, certified by a third party, that Berto produces its products according to certain rules and certain standards which ensure the protection of both the environment and the workers within the company.

As barriers to sustainability implementation faced by the company are the lack of general and universal norms for all the sustainability aspects. The company's Marketing Specialist states that "*the GOTS is only for the organic, the GRS is dedicated only to the recycled one, the OEKO-TEX is general at company level, but it is not unique for all the countries*". Hence, in some way, the company is suffering the lack of an unique certification that could cover all the sustainability issues. Instead, the company should follow several certifications and protocols for different products and processes, and this creates complexity with managing the sustainability within the company.

5.2.1.3 Candiani Denim

The Qualitative Research concerning *Candiani Denim* has been done through an interview and discussion with the *Sustainability Manager* of the company, which has an important role in the implementation and management of sustainability practices and strategy within the company, and through the analysis of secondary data such as the Sustainability Report of the company provided by it.

Candiani Denim was established in 1928 when Luigi Candiani, founded a small textile weaving company a short distance between Milan – one of the most important fashion and design capitals in the world – and the Alps, in a scenic nature reserve, Valle del Ticino. Candiani denim is a family-run company ever since its foundation. In the 1960s, Candiani started to recognize the growing market for denim and it was during this time, that Candiani became a vertically integrated company and dedicated only to the production of denim, which represents the current business of the company (Candiani Denim, 2019). Today Candiani is the largest denim

producer in Europe and is recognized as "The greenest textile company in the Blue World" (Candiani Denim, n.d.). Candiani Denim is located in Robecchetto con Induno (Milan), with two production sites and it is specialized in the production of both selvedge and stretch denim fabrics, ranging from 7 once to 16 once with a total production capacity of 25 million m^2 a year. Vertical integration and its large scale make Candiani's production one of a kind in Italy and in Europe as a whole. The process starts with the purchase of raw cotton, which then continues with *spinning, warping, dyeing, weaving, finishing,* and *quality control* activities. The company supplies and collaborates directly with some of the most prestigious international fashion companies and brands all over the world, such as Hugo Boss, Madewell, J. Crew, Citizens of Humanity, Tommy Hilfiger, Clavin Klein, Gucci, Liu Jo, Denham, Closed, Hallhuber and many others.

Figure 28: Candiani Denim's hang tag

source: https://www.facebook.com/candianidenimofficial/

As the activities performed by the company are several and include spinning, warping, dyeing, weaving, finishing, in general they are energy, water and chemical intensive and as a consequence produce high amount of emissions, textile waste and waste water. According to the Sustainability Manager of Candiani Denim the processes that require the most resources are the *dyeing*, as it use a high quantity of water and chemicals, and *finishing* as it use a lot of energy, water and produce CO_2 emissions.

From the interview with Sustainability Manager and from the analysis of the Sustainability Report of the company results that Candiani Denim is very committed to responsible and sustainable production. "*For us sustainability is a value we believe in a lot and we don't do it just for marketing, even if it is an added value also to the final product*" states the Sustainability Manager.

Environmental and social sustainable practices

At Candiani Denim innovation is equivalent to sustainability. The company strives to develop products and processes that are regenerative and have a positive impact on environment and society, while continuing to push the industry standards. The development of new sustainable technologies is not only crucial to the prosperity and quality of life for future generations, but it is also central to the company's long-term business strategy.

Although currently, the company has not a well-defined environmental and social sustainability management strategy, it is engaged and is working on defining a true strategy for the next ten years. The company owns a dedicated team with individuals in each production department which take care of a specific sustainability issue, and the Sustainability Manager coordinates all these actors within the company to manage all these aspects, ensuring that Candiani Denim's commitments are respected. It is also responsible for the continued monitoring and evaluation of progress made and communicating this to all stakeholders. Moreover, starting from 2015, the company has been drawing up the Sustainability Report, in which it communicates all its actions and practices towards sustainability.

With regard to the sourcing decision of the company, it is looking not only at the quality and technical perspective of the raw material, but also to their environmental performance. Indeed, Candiani was the first denim company to use cotton grown, produced, and marketed according to BCI standards. Currently, BCI cotton represents 40% of Candiani's annual cotton supply. The company is also producing some type of fabrics using 100% of organic cotton according to the Global Organic Textile Standard (GOTS). Currently, GOTS certified cotton represents 10% of company's annual cotton supply. Moreover the company is using recycled cotton yarns certified Global Recycling Standard (GRS) recovered from its production processes. The spinning of these yarns is performed by an external supplier, while Candiani performs the weaving activities. Other sustainable fibers are Tencel - which employs an highly sustainable closed-loop production system, Refibra – a recycled cellulosic fiber, Roica's elastic yarn certified GRS and Qnova – a regenerated nylon fiber which is produced using a chemical free mechanical process (Candiani Denim, 2019).

Regarding the dyeing and finishing phase, the company is using chemical auxiliaries that have a lower impact on workers, society and environment. In the dyeing phase, for instance Candiani is using only *pre-reduced indigo* certified OEKO-TEX, which compared to traditional powder indigo, decreases the use of two chemicals (sodium hydroxide and sodium hydrosulphite) commonly used to fix the indigo to cotton fiber by 50% - 60% (Candiani Denim, 2019). In the sizing phase the company employs an innovative technology Kitotex used solely by Candiani,

which is a polymer derived from recovered shrimps shells as a sustainable substitute for poly-vinyl alcohol, a common water pollutant and source of plastic pollution.

In order to create the denim fabric with the lowest possible environmental impact, technological innovation is essential to explore and develop new ways of doing things. The company owns a special dyeing technology **(N-Denim**) which allows to achieve denim with highly concentrated shades with less water and chemicals and a dyeing technique (**Indigo Juice**) which creates a very superficial penetration of the dye, which enables dyes to be washed easily during the laundry processes, thus employing less water and chemicals in the laundry. The combination of Indigo Juice and Kitotex results in a 75% reduction of water, and a 65% reduction in chemicals from both the fabric production and wash processes. Furthermore, the company employs a finishing technique which is a chemical and water-free process that creates high performance fabrics.

The processing residues and by-products are reused within the company or by other companies. For instance all the textile residues are collected and sold to companies that produce thermal panels and audio insulation. The company is also recycling the 35% - 40% of its processing water, by using the water twice. This implies that the water is used first in the finishing phase and after this phase the water is heated and used again in the dyeing process as washing baths. After the dying phase, the waste water is discharged and it is first treated within the company and after it is treated by an external water treatment plant. The technology supports the sustainability path of the company. Candiani Denim owns industry 4.0 technologies such as robotics and advanced automation technologies, smart technologies which improve the efficiency of the processes and reduce the processes waste.

With regard to the social sustainability, the company have been certified SA8000 since 2010 which concerns the social accountability of the company. This system defines the procedures to be followed to ensure the well-being of the employees, safe working environments and accident prevention. Moreover the company has a system which gives the employees the possibility to anonymously raise their concerns about their work conditions or corporate aspects and to make them visible within the company. Moreover, most of its employees have been working in Candiani for generations, hence their respect and well-being, good working conditions and social concerns are extremely important for the company.

The company owns several certifications and commitments, such as: OEKO TEX standard 100, GRS, GOTS, SA8000 and ISO 14001 and follow the ZDHC commitment (Candiani Denim, 2019). All these certifications and commitments were voluntarily implemented by the company in order to ensure that the company's actions are aligned with what communicated. An audit by a third party carried out every year controls the compliance with the certification. Thus, the certifications represent an added advantage for the company to convey confidence in the company to all the other players in the value chain. Furthermore they are also leading to end consumer confidence, as nowadays consumers are more aware about them.
Additionally, Candiani's *Code of Ethics* is an official statement of its commitment to guarantee high standards of health and safety for the workers and the protection of the environment. It is a promise to operate with integrity, honesty, and transparency while requiring the same from its employees, consultant, supplier, or customer.

Sustainable supply chain management

Candiani Denim is trying to improve the sustainability performance and standards of the entire denim industry. To achieve this path, it collaborates with some of its suppliers in developing innovative solutions. For instance, in 2016 Candiani created the *Denim Project 2.0* in partnership with Nearchimica SpA and Centro Tessile Cotoniero and Abbigliamento SpA, with the aim to identify innovative, eco-sustainable, and regenerative solutions, at both the product and process level, therefore to create the denim with the lowest possible environmental impact.

Moreover, it is screening its suppliers to ensure that their values are aligned with those of Candiani Denim. This level of screening provides the company the insurance that they work with, not only the best raw materials but also with outstanding partners and suppliers (Candiani Denim, 2019).

Although it does not happen very often, the company have been submitted to some audits from brands. Being in Italy, the audit focuses more on the environmental part rather than on social part. This is due to the stringent legislative Italian context and regulations which impose high social and working standards to be respected and that regularly monitor the compliance. Moreover, Candiani Denim is located in the Ticino valley nature reserve, Parco del Ticino, therefore the environmental aspect is becoming very relevant. The audits undergone by the company focused on the mere control and consistency of the documents required regarding the chemicals management, safety compliance, monitoring of waste water, use of energy and CO_2 emissions. In addition they focus on working conditions and control whether the employees

have protective gear, participate at safety courses or there is a system where the employees have the possibility to voice their concerns about the working environment.

Drivers and the role of brands

The drivers that push the company to become more sustainable are mainly internal and are represented by the ethical leadership of the owner, while continuing to push the industry standard. According to the Sustainability Manager "*The owner is very keen on environmental and social sustainability, because for him this is the only way to move forward. It makes no sense for him to produce only beautiful fabric which could then cause damage to the environment, workers and society*". However, the tendency of the company to be responsible dates to many years ago, with the owner's father and grandfather, even if at that time it was not thought as sustainability but more as efficiency. Second, being the company a family business for four generations, most of its employees are also families who have been working in Candiani for generations, hence their respect and well-being, good working conditions and social concerns are extremely important for the company. Another driver, which could be considered both internal and external, is the location of the company in the Ticino Valley nature reserve, Parco del Ticino, where it operates under extremely stringent environmental regulations, hence the company's commitment to responsible and sustainable manufacturing has been fundamental since the beginning. The location of the company leads to a complex legislative pressure for Candiani to be conscious of how its activities impact the environment and society, though the company is striving to go beyond the legislative requirements.

As external drivers that push to a responsible production are NGOs, who require specific compliances with the standards and those brands who are more sensitive towards these issues. Nevertheless, according to the Sustainability Manager brands have been more concerned about social aspects and then slowly they are moving also to environmental ones. Most of these brands have Ethical Codes or Codes of conduct that include criteria based on the norms and standards set by the International Labor Organization (ILO) as the main guidelines for social sustainability. For the environmental part, brands refer to ZDHC or REACH protocol as parameters for the chemical and environmental management. Nevertheless, the Sustainability Manager outlines that fashion brands have to push more on sustainability and to be more involved in sourcing sustainable products in order to transform the current fashion system. "*Even if we have many fabrics that incorporate these more sustainable aspects, but then if brands don't buy them, as they are more expensive, we cannot go on*" states she. This implies that since brands are those that coordinate the entire fashion value chain and commission the

products, they can lead to a more responsible fashion system by buying sustainable products. Moreover, it seems that brands focus more on price rather than on sustainability aspect incorporated into a product.

Traceability and transparency

The company aims at increasing transparency and to communicate its values and the responsible production carried to the end consumers. On April 2019, Candiani opened its first shop in Milan, where it sells the denim products of their customers which are the most aligned with its values of sustainability and responsible production. The aim of this shop is to better explain to the end customers who are the actors that stay behind a brand and the processes behind a pair of jeans, as well as to highlight the relevance of responsible production and the brands engagement with sustainability. "*Often consumers do not know that there are other stages such as washing and finishing after the sewing of a denim garment where all the treatments and effects are done, which are also demanding from the point of view of the use of water and chemicals*" states the Sustainability Manager.

With regard to traceability, the company is able to trace its products internally, by identifying where the products are located and in which phase of the production process is the production batch. The industry 4.0 technologies used by the company aims at improving the internal and external traceability of the company.

Furthermore, it can also track the impact on water, use of chemicals, energy and CO_2 emissions of their production processes. However, this system is not really integrated, hence the traceability of the impact and of the environmental performance is not a real time traceability, but can be performed only after the process is finished and the total consumption of the production batch measured. Given these restrictions, the company is not able to perform a Life Cycle Assessment (LCA) of its products, which is a very requested activity by some of the denim brands as they want to know exactly the impact of the denim fabrics they are buying on environment. Therefore the company is looking for a more integrated and smarter system which could merge in a digital way all the production departments and could provide a real-time monitoring of environmental performance. The Sustainability Manager states "*Eventually, we are evaluating the use of RFID or other types of tags, especially for cotton, and we are working on the implementation of the Blockchain for traceability - it is a project in development, not implemented yet".* Candiani is working on implementing identification tags starting from cotton fibres, since nowadays the origin and the type of the cotton fibres is a very sensitive part in the fashion system.

The company can also trace its suppliers of productive inputs, as it has close relationships with most of its suppliers of raw materials. Indeed, it is able to trace its suppliers of chemicals, due to the maintenance of long relationships with them and their location in the same area as Candiani, thus they interact often. Regarding the cotton traceability, the Organic cotton has a Transaction certificate that guarantees that it is organic which is applied to every phase of production chain, hence it is completely traceable. The BCI cotton and conventional cotton are more difficult to be traced up to the farmers, especially in developing countries. As the farmers are relatively poor and have no resources to have their own ginner, they bring their cotton to a ginner which mixes the cotton from different farmers together. So, the company is able to trace the conventional cotton until the ginner, but it becomes very difficult to identify the farmer that cultivated a specific cotton. However, Candiani tries also to have relationships and direct contact with its farmers to enhance the traceability within the value chain.

Moreover, the company provides the information regarding its suppliers to its clients/brands, and in this way brands are able to have a full image about their value chain and to increase the transparency of their value chain. However, the willingness of the brands to publish this information is quite limited. And even those who want to trace their value chain and to communicate it to their stakeholders, they usually ending up at the fabric level. For instance, they communicate that the denim is manufactured by Candiani Denim, but they do not provide further information about the suppliers of Candiani. This is line with what outlined by the literature, which states that usually brands trace only their first-tier suppliers (Ditty et al., 2019). However, brands are more prone to publish the name of Candiani's suppliers which are well-known in the market or to the end consumers as producers of sustainable products, because in this way the transparency can bring them benefits in terms of enhancement of brand value and reputation. An example of a supplier of Candiani that is communicated and published by brands together with the denim fabric is the Canepa company which produces the Kitotex product, a type of sustainable polymer.

When it comes to the communication by brands about the sustainability of the value chain processes performed by its suppliers, the interviewee outlines that the percentage is very small. In particular, European clients of Candiani are more prone to communicate information regarding sustainability performance compared to American brands. If on one side some brands are limiting their communication activity by telling that the denim used in their products are from Candiani, without explaining all the savings and sustainability performance that is behind the denim fabric. Others, instead such as Madewell, Closed use a hang tag similar to that in the

Figure 28 which certifies that the jeans were made by Candiani's denim and explains the fabric, the sustainable approach of the company and its philosophy.

Benefits and challenges

Regarding the benefits for Candiani resulting from sustainability processes regards the improvement of the health of employees who work within the company. Furthermore, keeping the processes and products sustainable, the company is able to become more efficient and to save valuable resources and the amount of waste discharged into the environment. Another benefit is the added value to its fabrics though which Candiani wants explain to all the actors part of the denim value chain why it is better to behave in a sustainable way.

The main challenge to keep the processes and products sustainable for Candiani are related to the difficulty to keep pace with the fast changing markets and with all the innovations that are emerging. The sustainability Manager claims "… *there is always something new in the market, so sometimes it is difficult to be in front of all these changes".* Another challenge is related more to the economic part. In order to become sustainable, the company has to sustain considerable investments in research and adoption of innovative technologies, however these efforts are not paid off. Indeed the interviewee states "…*we have not yet reached the point where the market or all consumers are willing to pay more for a sustainable product*" and she continues "*I think brands are still price driven, so they want to have the story of sustainability but at the same price*". Therefore another barrier to sustainability is represented by brands themselves, because they are not willing to pay more for sustainable product, thus discouraging firms from investing in sustainability. Although it is commonly thought that brands are representing the drivers for sustainability, the Candiani Denim case shows that brands could represent a barrier to its implementation, as they are more centered on price and not that committed to sustainability aspects. Moreover, nowadays the sustainability aspect is very popular topic within the fashion system, and many companies are trying to embrace it in their communication. Nevertheless it is not clear who is doing things for real and who is doing greenwashing instead. This represents a challenge to sustainability, because the company has to put more efforts to communicate and to show continuously its actions and practices, to convince the end consumer that even if he has to pay a higher price for a denim item this is actually sustainable.

5.2.1.4 Cross case analysis in the yarn and denim production phase

After the within-case analysis of the different players specialized in yarn and denim production phase of the value chain, in order to have an overall picture of the denim production step it is

necessary to do a *comparative analysis* or a *cross-case analysis* of the companies. First of all, it is important to highlight that the investigated companies differ in terms of *size*, *turnover*, *number of employees* and *activities performed*, therefore it is important to consider these variables during the analysis.

Approaches to sustainability

By analyzing the three companies, different approaches to sustainability emerge. **Candiani Denim** is pursuing a ***value seeker*** approach to sustainability. This approach implies that the company is always striving to *go beyond legislative requirements* and is constantly *exploring and developing* new ways and techniques of making products and production processes sustainable. The aim of the company is to push the denim industry's sustainability standards further and further each year and with every new product release (Candiani Denim, 2019). The presence of a sustainability team which supports the company's implementation of the sustainability strategy and policy, and provides strategic guidance throughout is very relevant towards this achievement. The value seeker approach of the company is highlighted also by the *Denim Projet 2.0* which is a result of a collaboration with several actors of the denim value chain to influence the sustainability future of the denim fabric. Several sustainable denim fabrics culminated from the Project. Furthermore the company owns two Development Centers, one in Italy and one in USA, whose purpose is to provide technical guidance to clients on how to achieve aesthetic washing results combined with a superior sustainable performance, reducing water, energy, chemicals and CO2 emissions. The value seeker approach can be also seen in the aim of the development center which is that to *educate* its clients on the favorable use of denim fabrics in terms of cost-effectiveness and sustainability, especially regarding the laundry and the final finishing processes (Candiani Denim, 2019). Candiani Denim is engaged with research and development and invest in several technologies, techniques and sustainable solutions to strike a balance between environmental, social and economic performance, while simultaneously driving a sustainable revolution industry wide. This approach of the company is internally driven by the company's values, history and the long sustainable path pursued by it which provided it with the moniker "The Greenest Mill in the Blue World." Having this title, the company is even more committed to sustainability and to communicate and explain their approach in order to defend the claim.

Contrariwise to Candiani Denim, **Manifattura di Cene's** approach to sustainability can be interpreted more as an ***efficiency*** approach, which implies that the company aims at producing less waste and consuming less resources in each step of its operations mainly for economic

reasons. The company have started to address the sustainability issues primarily to reduce costs and to ensure compliance with existing regulations. Thus, the sustainability approach followed by the company is seen more within the lens of economic sustainability and efficiency rather than within environmental or social sustainability lens. This implies that the company by reducing the resource waste and by performing recycling activities of water and fibres, intends in the first place to reduce its costs associated with its operations, and this in turn results also in a more sustainable processes and working environment. It is also adopting additional sustainable practices to reduce costs – especially energy costs by owning a hydroelectric power plant that generates renewable energy, but do not recognize any opportunities to obtain a competitive advantage through sustainability. Indeed the company aims at providing a good quality product and service to their customers rather than putting sustainability at the center of its processes and strategy. However, the approach pursued by Manifattura di Cene can be influenced by the financial situation of the company. The company is finding itself in a critical situation, due to the foreign competition and to the fact that its market is represented only by Italian firms which in the last years many of them closed their business, so the company is suffering this situation. Therefore the company is following an efficiency approach to be able to continue its business. However, the activities performed by the company may have an impact on the approach pursued. Manifattura di Cene performs only the spinning activities, thus it does not employ any wet processes, which are those that are the most critical ones in terms of environmental and social costs. Given that the company is not performing these activities, the sustainability requirements are more limited.

The **Berto**'s approach to sustainability can be asserted as ***value-seeker*** as well. The company is doing constant research and invests in more sustainable solutions. It implements relevant efforts to include sustainability in their operations and activities in addition to provide high-quality products. Within company's operations sustainable practices are implemented for the development of new water and energy-saving solutions. Berto treats its industrial waste and recover it, reducing its impact on the environment. The company pays great attention to raw materials, water recovery, sustainable alternatives and more eco-friendly chemicals. Moreover, it is committed to guarantee the fair conditions for the employees and safe working environment. To monitor the sustainability performance, the company is able to trace the use of resources such as water, energy and chemical auxiliaries, and to improve its performance on the basis of these results. However, compared to a value seeker approach followed by Candiani, the value-seeker approach followed by Berto is characterized by a sustainability implementation circumscribed more to the internal borders of the company. When analyzing

the approach follwed by Berto, an important variable to be taken into consideration is the company size in terms of employees and turnover. Compared to Candiani which employs 582 workers and has a turnover of 80.000.000, Berto is much smaller both in terms of employees and turnover. Investments in advanced sustainability projects require large amount of capital in R&D and in innovation, which can be more easily supported by larger firms such as Candiani.

The role of technology

The cross-case analysis reveals that in all the three cases, *innovation and technology are key* to implement sustainability and to improve the company's environmental and social performance. Since all the three companies are performing either the spinning or weaving activities or both of them, the textile waste (dust, fluff and other textile by-products) is an important concern to the wellbeing of the workers. Thus, *all the companies own an innovative air conditioning system* which ensures the necessary humidity of the cotton, while at the same time providing the air conditioning in the department for the workers, enhancing in this way their wellbeing and reducing breath health problems. All the three companies employ modern technology in their activities, which allows them to be both more efficient and to improve their sustainability performance. In the case of Manifattura di Cene, the availability of modern technology is a driver that pushes for the sustainability implementation within the company. The new technology enables energy and CO_2 emmisions savings, employees wellbeing due to the automation of activities, less resource waste and higher product quality. Also in the case of Berto, sustainable upgrades through technology represent the tool through which the company strives to become more sustainable. Indeed, the company employs high energy efficiency frames to save energy, waste and CO_2 emmisions. Moreover in the dyeing phase the Berto and Candiani Denim use innovative solutions such as pre-reduced indigo, innovative dyeing techniques and Ozone Machineries for the finishing that reduce the use of water and chemicals, while reducing the creation of waste water.

Also Candiani's sustainable performance is due to upgrades in every company's department. In the weaving department, the company employs an efficiency device called the "Selvedge Saver" added to the weaving looms which allows 62% of savings in yarn consumption. Sustainable upgrades in the finishing department result in new highly efficient machinery employed to achieve better stability performance of stretch fabrics by consuming less energy. Moreover, the introduction of the "Shaper technology" allows to develop a chemical less and waterless finishing for stretch fabric. Furthermore, the companies that perform wet activities (Berto and Candiani Denim) are owning a water treatment technology that treats the waste water within the company.

Nevertheless, the new technology contributes not only to the superior sustainable performance, but also to the traceability of products and to the track of the sustainability performance within the company. For instance, Berto, thanks to its Supply chain management system "AS 400", is able to trace its products internally from the first phase of production until the warehouse. Furthermore, the company is able to perform a Product lifecycle management which with the data deriving from the system analyses the life cycle of raw materials, semi-finished products and finished products with the aim to reduce errors and waste, increasing product quality and safety and to monitor the use of water consumption, energy and consequently CO_2 emissions. Likewise, Candiani Denim is able to trace internally its products and it can also track the impact of its production processes on water, use of chemicals, energy and CO_2 emissions. The company is also able to trace its suppliers of raw materials such as fibers, and chemical auxiliaries and dyes, as it establishes lasting relationships with its suppliers and tries to source as locally as possible in order to enhance the transparency and traceability of the value chain. Contrariwise, Manifattura di Cene does not own any Information Technology systems which could allow the traceability of its products neither internally nor externally.

Benefits and challenges

From the analysis, emerges that the benefits from sustainability are several. For Manifattura di Cene the benefits are mainly associated with cost efficiency resulting from the production process, employees wellbeing and high quality products. For Berto, the benefits, in addition to those of Manifattura di Cene, are also related to the ability to produce safe products to the end consumers, to improve the value of the products, to guarantee brands that the products from Berto lave a reduced impact on environment and society and respects specific standards, thus is also a marketing tool that enhance the brand value and image. For Candiani, the benefits resulting from sustainability are the improvement of the health of employees who work within the company, higher efficiency, waste reduction, added value to its fabrics and the possibility to push the industry towards more sustainable practices by developing several projects and sustainable solutions in collaboration with other actors of the denim value chain.

Despite the growing attention to sustainability in the denim industry and the companies' efforts to become more sustainable, the market focus is still more product oriented and cost-driven. This aspect have been highlighted both by Candiani and Manifattura di Cene. Indeed, brands are more focused on price, rather than on sustainability performance of the products they buy. Hence, it could be considered a challenge to sustainability practices implementation at the interviewed companies, especially for companies that depend on their clients. Another

challenge identified is the lack of a general and universal norms that could cover all the sustainability issues. The companies have to follow different Certifications and Standards in parallel for various sustainability aspects, and it becomes complex, confusional and time consuming to manage all of them together. The same has been highlighted by Candiani's Sustainability Manager which states that "*Certifications have become very demanding, as they are very bureaucratic and administrative, so from this point of view it takes a long time. For example, we have a colleague who follows only the part of the certifications".* Other challenge to sustainability implementation is represented by the difficulty to keep pace with the changing fashion markets and with the all the sustainable innovations emerging into the market. This process is very demanding both in terms of financial and human resources in R&D and adoption of new technologies. The Greenwashing effect is another barrier that hinders the sustainability development and is a result of the lack of transparency in the fashion industry. As it is difficult to understand for customers whether a firms is really committed towards sustainability or not, the companies have to increase their efforts in being transparent and to show clearly the actions they are performing. To guarantee this, the companies are in fact, adopting several certifications with the aim to give to the customer, brands and the market the security certified by a third party that the company produces according to certain rules and certain standards that ensure the protection of both the environment and the workers within the company. As emerges from the *Table 3*, all the analysed companies own a Global Recycling Standard (GRS) certification.

Table 3: The Certifications and Commitments of the interviewed companies

Manifattura di Cene	Berto Industria Tessile	Candiani Denim
Global Recycling Standard (GRS)	Global Recycling Standard (GRS)	Global Recycling Standard (GRS)
	OEKO TEX Standard 100	OEKO TEX Standard 100
	Global Organic Textile Standard (GOTS)	Global Organic Textile Standard (GOTS)
	ISO 9001	ISO 14001
	DETOX commitment	SA8000 Social Accountability
	REACH	Zero Discharge for Hazardous Chemicals (ZDHC) commitment
		Code of Ethics

author's elaboration

This implies that all the companies are producing yarns and fabrics from recycled fibres. Compared to Berto and Candiani, Manifattura di Cene owns just the GRS certification. The limited number of certifications owned by the company could be connected to the activities performed by it which are just the spinning activities. Thus the company does not perform any wet activities and as a consequence it does not need certification regarding the hazardous chemical management. In addition to this, Candiani Denim and Berto have in common the OEKO TEX Standard 100 and the GOTS certification. However, the companies own other

certification and commitments that differ among them such as DETOX and ZDHC commitment which deal with the chemical management. The companies own also social certifications and standards which are ISO 9001, ISO 14001 and SA8000.

5.2.2 Garment Finishing

5.2.2.1 Everest

The Qualitative Research concerning *Everest* has been done through an interview and discussion with the *General Manager* of the company, which has an important role in the implementation and management of sustainability practices and strategy within the company (*see the questions in Appendix 4).*

Everest is a Laundry and dyeing company founded in 1976, that offers a complete range of textile treatments for the fashion sector on finished garments. For denim garments the company provides an old-looking effect and a fashioned image to them. The solutions the company deliver to its customers are continuously evolving, keeping up with the rapid changes in style in the fashion industry. The headquarter of the company is located in Piombino Dese (Padua), and the company owns other two branches in Tunisia and Pakistan. It is the largest laundry and dyeing company in Italy due to the investments in technology. The main clients of Everest are Diesel, Replay, Armani, Benetton and Acne. Therefore the company works for clients who are operating in the premium segment as well as clients who operate in the mass market. The services offered by Everest include washing treatments and dyeing, thus these activities are water, energy and chemical intensive and as a consequence could create high quantities of waste water, CO_2 emissions and safety problems in the working environment.
From the interview with the General Manager of Everest, results that the company is highly committed to sustainability, by introducing new technologies that permit to save valuable resources and by implementing more sustainable working practices within the company. The goal for Everest is to reach the zero pollution activities, thus trying to treat and dye garments without water, using less possible chemicals and less human exploitation, so that machines are increasingly used on clothes.

Environmental and social sustainable practices

Although the laundry and dyeing activities have been always considered low-tech and labor intensive, Everest for many years has invested in technology which allows the respect of the environment and people. The technologies employed by the company in the denim treatments and dyeing processes are:

- *Ozone machines*: they are machines that can bleach denim garments only by using gas, without using water and other chemicals;
- *Laser*: the laser replaces the manual processes for doing whiskers and sanding. Whiskering and sanding are very long activities and are usually performed manually, thus they can lead to employees fatigue and breath problems due to the contact of the operator with the denim dust resulting from these processes. The laser, instead, shoots very powerful bands of light on denim garment, so as to degrade it where this light hits;
- *Jet Dye* for the dyeing process: the jet dye dyes the garment at a high pressure, hence it allows to obtain water saving of about 70%, which in turn translates in energy or gas savings to heat the water for the dyeing process, as the garments are dyed at 90 degrees;
- *Nano Bubble or Fogwash*: it is a machine that instead of using water, sprays small bubbles with chemical products, which enable to reduce the use of water by 90%, the use of energy and the use of chemicals compared to a standard wash, and consequently a much less impact on environment and society.

All these technologies are automation systems which help to reduce the environmental impact and to facilitate the work of employees and to enhance their wellbeing, by substituting the manual processes with automatic ones in which the employees are mostly in charge of controlling these processes. Therefore, the company acquired both a work method that allows to save resources, and purchased machines that reduce water. As a procedure feature, by keeping everything unchanged for the same machines, the company is able to reduce the use of water by 50% only by changing the working method. In addition, by employing new machines that further reduce the use of water such as Jet Dye, it is able to save 70 % of used water and energy. As the manager states "*By reducing 70% of the water used, I also reduce 70% of the energy in terms of electricity and gas to heat the water, because to dye we have to go up to 90 degrees with an average dyeing cycle that lasts four hours"*.

For the waste water the company owns an internal biological treatment plant which returns clean water which is then returned back into the river and the sludge containing the sand of pumice stones and residues of fabric which is taken away as special waste. The company monitors daily the use of water and continuously control the values of the treated water.
Everest is taking care of the logistics, and delivers the products. To reduce the CO_2 emissions during distribution, the company is trying to make the vehicles to run as full as possible and employs two semi-electric vehicles in order to pollute less.

The company is very sensitive towards the sustainability issues. From the social point of view, the company is a family business and the relationship established between employees and the owner is more than simply an employer-employee relationship and the company is like a large family. Therefore, it pays greater attention to the wellbeing of its workers and their working conditions. The company provides courses to its employees, especially to those who work with chemicals, every six months or annually depending on the type of activity performed by the worker. It also own internal code of conduct that covers several social aspects, from the avoidance of child labor within the company, limited overtime, to welfare services provided to employees and continuous medical examinations. Moreover the company owns an letterbox where each employee can anonymously express their concerns about potential improvements or issues, in this way the company could understand the internal problems.

Traceability and transparency

With regard to traceability, the company owns an internal management system that is continuously updated and enables the internal traceability of goods, so it is possible to establish the progress status of the products it process. Furthermore, the company employs the barcode technology that facilitate the traceability within the company. It is also able to track the sustainability performance of its processes. It owns a software **EIM (Environmental Impact Measurement),** which measures the amount of *water, energy, labor* and *chemicals* consumed during a specific treatment and it helps Everest and its customers to understand how much impact the washing has on the environment. Through an evaluation processed with preset values, a numerical rating[12] is displayed, which can be assigned to low impact, medium impact and to high impact. These values are shared values by the main international brands in the denim sector. Moreover by owning these values, Everest can communicate it to its clients, hence brands can use them to certify their denim garments and to improve the value chain transparency. Indeed, in the recent years, brands have started to increasingly communicate about the sustainability of their products and about the sustainable practices implemented by their suppliers. The manager of Everest claims "*it is a plus that we give, beside the physical attributes to the garments, also as a reputation that this product is made with eco-sustainable technologies and is obtained with eco-sustainable washes*". It can be used as a marketing tool to enhance the brand reputation. Some brands may write on the labels that the products was

[12] The rating is the sum of the scores attributed to the following variables: the quantity and type of chemical products; the time spent by chemical products within the process and the time taken to do the manual work, the consumption of electricity or gas used to produce the garment and water consumption.

manufactured by saving water, without the use of chemicals and other similar sustainable practices.

Drivers and barriers

The drivers that stimulate the company to become sustainable are both external and internal. As an internal driver, it is the *internal management mentality*, who aims at achieving sustainability goals. Indeed, the interviewed manager studied at Universities in Northern Europe which contributed to the development of a more sustainable mentality.

As external drivers, the company was working for many years with important clients in Northern Europe, which were more sensitive towards sustainability issues than the rest of Europe countries. Indeed the manager states: *"…in Italy, this eco-sustainable sensibility has arrived a little bit later than in other European countries*". Therefore working with clients which were more concerned about environmental and social issues, pushed the company to start its approach to sustainability earlier and to become more sensitive on these issues. Besides the marketing push, another driver on sustainability is given by the *legislative regulations* that are shrinking both environmental and social tolerance parameters. Furthermore*, brands are increasingly demanding specific environmental, social and chemical requirement*s such as eco-friendly treatments. Some of its clients are applying a code of conduct which contains the principles of the respect of people and society, although they require the same as the national law. Moreover the company have received lists of prohibited substances, which have to signed by the company to guarantee that these substances are not going to be used within the garment treatments. Given these requirements, the company has been submitted to several audits from its main customers. The audits are carried out by a third party and are focused both on the social and chemical aspects. However, the audits have not influenced the company's operations and activity, as the company from its beginning has tried to be compliant with the national laws, therefore it was already complying with the requirements imposed by social and chemical audits.

In order to face the pressure for sustainability, Everest owns OEKO TEX and ZDHC certifications. Furthermore the operators performed the ZDHC courses about how to store and use the chemicals within the processes to prevents the working incidents. Nevertheless, the achievement of certification is something voluntarily decided by the company, although it is the market that is increasingly asking for it. The sustainability manager states: "*The more a company is certified, the more attractive it is in the market. On the other hand, following certain processes, the certification comes almost automatically*". Therefore, it becomes quite a natural path to be followed if a company aims to achieve the sustainability goals.

According to the manager of Everest, the supporting industries such as the producers of machineries and the chemical producers for textiles are helping the laundries to become sustainable. The producers of machineries are developing new technologies which allow to reduce the amount of water, energy and chemicals used for a process. Whereas the producers of chemicals are developing chemicals certified ZDHC or GOTS, which are those required also by the brands.

The difficulties with sustainability are due to the fact that many times the requests from brands are not consistent with the reality. This is because most of them do not have much knowledge about sustainability but they are trying to push on sustainability because it is fashionable today, making non sense requests. Therefore, it becomes very challenging to satisfy the requests coming from some brands.

5.2.2.2 Cleantex

The Qualitative Research concerning *Cleantex* has been done through an interview and discussion with the director of operations which has an important role in the management of the operations of the company (*see the questions in Appendix 4*).
Cleantex is a company located at Sarcedo (Vicenza) which is specialized in the garment ennobling and finishing. The company works for several famous Italian brands such as Bottega Veneta, Valentino with whom it works directly, and has a sub-contractor relationship with Staff International which manages Dsquared2 and Margiela brands.

Environmental and social sustainable practices

From an environmental point of view, the company equipped itself in such a way to avoid the use substances and chemical auxiliaries that are not compliant with the Reach protocol. It periodically controls the chemicals auxiliaries delivered by their chemical suppliers in order to check whether the products are compliant or not. In addition, Cleantex has a photovoltaic system which generates energy, hence it guarantees quite 50% of the used energy. Moreover, the company is reducing the packaging waste by recycling it internally.

The innovation regarding the technologies was focused more on software rather than on washing techniques. This software innovation made the processes more automated, thus the manual work of the operator is reduced and improved the repeatability of the recipes and the internal traceability of the processed products. Moreover the company owns two recent

machines that perform a partial recycling of the used water and enable to obtain savings of 50% of the water used in the production processes. The waste water resulting from the processes is treated by the company's chemical purifier which cleans the water up to C table. After this internal treatment, the water is treated in a consortium purifier which further cleans the water up to the values of drinking water.

Concerning the social sustainability, the company is providing training courses requested by the local regulation to its employees. Moreover, through the automation of the processes, the operators work less manually and as a consequence improves their wellbeing.

Traceability and transparency

With regard to traceability, the company is able to trace all its production waste, as it relies on an external company for this activity and which provide Cleantex with all the information about where the waste is going. Based on the invoices provided by its suppliers of chemicals, the company can track the chemicals used in its processes.

The company is monthly monitoring water, energy and CO_2 emissions. The water analysis is done by a private chemical office that certifies that the water is compliant with the standards. To control CO_2 emissions, the boiler is checked for a better functioning and an annual smoke control is performed. During the analysis of the smokes, the company is able to obtain information about the amount of pollution resulting from the processes. However, the boilers are powered by methane, so the impact of CO_2 is under control from the beginning.

Drivers

The sustainability drivers for the company are mainly external drivers. Among the external drivers are the requests and suggestions of the brands or clients. The company, in fact, received several lists of prohibited substances from its clients, in order to avoid the use of specific chemicals in its processes. Moreover some of its clients have applied a code of conduct and provide Cleantex with roadmaps to be followed in which provide several measures regarding environment, work system and personnel, thus guaranteeing their compliance with the policies. This approach is used as an alternative to certifications, given that the company does not own any which could guarantee the conformity. Also the suppliers of chemicals could be considered both an external driver or a facilitator of sustainability implementation, by offering alternative solutions which have less impact.

The company have been submitted to several audits from brands. However, the audits have not influenced the company's operations. As the interviewee states "*we have had to change very few things, because regarding safety from the health point of view and from a sustainable point of view, we had already equipped ourselves enough".*

5.2.2.3 Laundry A

The Qualitative Research concerning *Laundry A* has been done through an interview and discussion with the owner of the company (*see the questions in the Appendix 4*). The company is identified as Laundry A, as the owner wanted to maintain anonymous the name of the company.

Laundry A is a denim laundry and dyeing company which treats finished garments made from several fibres such as cotton, silk, polyamide and viscose, except polyester. The company was founded in 1987 and it has been transformed from a small craft firm to a key player in the fashion district, thanks to the union of its peculiar technical skills and its advanced approach to industrial process organization. The company is located in the Province of Vicenza and it has an office dedicated to denim which is located in the province of Verona. The company provide its services directly to brands or through the intermediation of service firms, which are companies that produce clothing for third parties. The company's clients are brands such as GAS, Fashion Art, Bottega Veneta, Levi's and many others.

Environmental and social sustainable practices

From the interview with the owner results that the company is committed to sustainability. Thanks to the innovation in machinery technology and techniques the company have been able to save the water used in the washing processes. The company is using machines that spray water and chemicals, thus using less water. Also Ozone machines employed by the company lead to water saving, as it requires half of the amount of rinses to clean the denim. These technologies together with the new chemicals or new chemical formulations allows the company to achieve a 50% or 70% of the water savings compared to a conventional wash. The majority of the company's machines are manual machines which implies that they are loaded manually by the operator and are controlled by an on-board computer that monitors the recipe of a treatment or of a dye and the temperature of the activity. Through these on-board computers, the company can trace the processes carried over time and to increase the quality of the final product.

The waste water resulting from the processes is treated internally by a purification plant which is continuously controlled. After the internal treatment, the water is discharged into the

consortium purification plant where the water is further treated and the company pays a sewerage fee for this.

The company started voluntarily a company-wide path for ensuring the safety and quality of the products it processes, in order to guarantee the absence of harmful substance to society and environment. Since 2014, the company owns the *By your side certification* developed by the Ritex, a laboratory for research and textile testing. The path provided by the certification is given by the consulting services provided by Ritex on legal obligations (REACH), updated courses on regulations and analysis of materials to demonstrate the full compliance of the company with the standards. Currently the company is carrying out the second phase of the By your side path, which regards the control of the chemical part of the dyes and the elimination of those products that are considered unsustainable and highly impactful on society and environment. With this second phase of the certification, the company aims at ensuring the traceability of the chemical products used within the company's processes to establish, even after a period of time, which chemicals and dyes and of what batch have been used to treat or to dye a specific product.

Drivers and challenges

The drivers for sustainability are both external and internal. The internal drivers are related to the willingness of the owner to be at the forefront of sustainability, to reduce the negative impact of company's operations. As an external driver is the market driver. The theme of sustainability is very common nowadays and thus the market pushes the companies to implement rigorous procedures, but also to continuously improve standards in terms of product safety and quality. While some brands are monitoring the company's activities by submitting it to audits carried out by third parties on behalf of brands. Other brands simply let the company subscribe to specification and rules and do not perform any audits. The audits undergone by the company were focused mainly on the topic of employees such as the contracts of employees, no child labor, and the safety of the working environment. However, the audits have not lead to changes in the way the company operates, since it was already compliant with what the audits require.

A challenge to the implementation of sustainability practices for the company resides in the composition of dyes or chemical auxiliaries. For instance, the dyes used for cotton contain salts that raise the salinity of the waste water which is difficult to be eliminated. Therefore it challenges the water re-use and recycling within the company. Another challenge is the limited availability of alternatives for synthetic dyes and chemicals. Although on the market exist several natural dyes, they are limited in quantity, solidity, range of colors that can be reproduced

and are very costly. As the owner of the company highlights "*if we decide that from tomorrow all the companies must use natural dyes, there would be absolutely no possibility of having them, because the dyes that come from plants or herbs would not be enough to dye all the cotton and wool that are dyed".*

The fact that there is no a clear path with clear instruction about what should the company do to become more sustainable. Most of the times, companies are aware of the unsustainability of the current fashion system and that actions should be taken to reduce the social and environmental impact, however the absence of a clear path to be followed may challenge the sustainability implementation.

5.2.2.4 Cross – case analysis of the Garment finishing phase

After the within-case analysis of the different players specialized in the garment finishing phase of the value chain, in order to have an overall picture, it is necessary to do a *comparative analysis* of the companies. First of all, it is important to highlight that the companies differ in terms of *size*, *turnover*, *number of employees*, therefore it is important to consider these variables during the analysis.

The approach to sustainability

The approach to sustainability performed by Cleantex could be deemed as ***reactive.*** The drivers that pushed the introduction of the sustainability practices within the company are mainly external drivers, such as the requests and suggestions of the brands, clients, suppliers and the market. Therefore, the company's actions are directed towards the compliance with the existing regulations. For instance, the company periodically controls the chemicals used to be compliant with the REACH protocol and avoids those that are non-compliant. Regarding the social aspect, the company is providing training courses to its employees requested by the local regulation. The company is also adopting some sustainability practices to reduce costs by owning a photovoltaic system which allows to reduce the costs of energy bills. Within its processes, the company concentrated its efforts solely on marginal improvements which allow to increase the quality of the products and to reduce the manual work of the operators, instead of pursuing a path towards a radical sustainable change with modern technologies which could allow to save high quantities of resources and to reduce the impact. Except could be considered the two new machines that enable to recover partially the water and to obtain some savings. However, it is important to take into consideration the size of the company both in terms of employees and turnover. In fact the company is very small compared to the other two laundry companies,

therefore it may lack human and financial resources to implement the more advanced sustainable practices.

The approach to sustainability pursued by the Laundry A is a ***proactive*** one. In fact, the company has started voluntarily a sustainability path assisted by the Ritex laboratory to guarantee the safety and quality of the products it processes both for society and environment. In addition, the second part of this path is aiming to obtain a systematic control of the chemicals and to ensure the traceability of the chemicals used within the processes to monitor the chemical safety of the products. Therefore, it is trying to implement some solutions that go beyond the standards and principles imposed by the existing regulation. Moreover, Laundry A adopted innovative technologies and machineries, such as Ozone Machines which require half of the water compared to traditional machines, thus sawing high quantities of water, energy and CO_2 emissions. The drivers for sustainability are related to the willingness of the owner to improve company's commitment to sustainability and to reduce the negative impact of company's operations, as well as external drivers related to the relevance of the sustainability aspects in the fashion industry which push the companies to continuously improve standards in terms of product safety and quality.

If we compare the approach of Everest with the other two laundries, we can conclude that Everest is pursuing a ***value seeker*** approach. The approach to sustainability is supported by a strong involvement and commitment of the internal management, which owns a sustainability mentality and drives the path of the company. By implementing advanced sustainability practices, the company aims at creating a competitive advantage based on a sustainable image of the company, and the high commitment of the internal management shows their believe that sustainability is and will be even more a winning factor in the market. As an external driver that contributed to the company's approach was the presence of some of its clients that were more sensitive towards sustainability issues, thus the company started its approach earlier than its local competitors. The company invests in research of new production methods and new machineries that allows to achieve high quantities of water savings and to reduce the amount of chemicals employed in a certain process and consequently a much less impact on environment and society. Moreover the company invested in technologies that replace the manual activities and reduce the negative impact on employee's health. Furthermore, the company is very sensitive about the social issues. The health, safety and wellbeing of employees is paid a special and dedicated attention. Specific procedures and written rules are defined in the code of conduct and distributed in every part of the company. The continuous

training of all employees is also a top priority, especially for those operators that deal with the chemicals. Through the theme of sustainability, Everest strives to achieve water, energy and chemical savings, increase in employees motivation, productivity and wellbeing and even economic savings, therefore providing higher value with lower costs to the products offered to brands. In this way the company identifies a synergy between sustainability, quality requirements and cost savings, and this coexistence make the company to approach the sustainability issues in a more dynamic way.
The value seeker approach of company is facilitated also by the size of the company; among the three interviewed companies, Everest is the largest one both in terms of turnover and number of employees, thus it may own more resources to dedicate to sustainability.

Everest owns the OEKO – TEX and ZDHC certifications for chemical management, in order to satisfy the increasing requests coming from brands, to increase its attractiveness in the market and to make its sustainability path more complete. Laudry A possess the By your side certification to ensure the chemical safety of the products it processes. This certification represents the company commitment to continue the sustainability path started some years ago. Unlike Everest and Laundry A, Cleantex do not possess any certification but it is following the REACH regulation and comply to the lists of prohibited substances from its clients. In fact the interviewee claims " *Our customers do not require us to have certifications. They give us roadmaps in which they guarantee that we are on their certification with regard to environment, work system and personnel".* Therefore, whether in the case of Everest and Laundry A the need for certification is pushed in part by the market and in part by the sustainability path followed by the company, Cleantex have not received any pressure for certifications and it is trying to follow the standards established by its clients or by the regulation.

The role of technology

The cross case analysis reveals that all the three cases, *innovation and technology are key* to implement sustainability and to improve the company's environmental and social performance. Whereas for Everest and Laundry A, the innovation concerned more the change of the washing techniques and machines, the innovation regarding the technologies of Cleantex was focused more on software. The technologies employed by Laundry A and Everest in the denim treatments are *Ozone machines*, which are machines that can bleach denim garments only by using gas, without using water and other chemicals, and *Fogwash* which sprays water with chemical products and allows to reduce the use of water, energy and chemicals. Everest employs also the *Laser* as an alternative to the manual processes for doing whiskers and sanding

and the *Jet Dye* in the dyeing process which dyes the garment at a high pressure and provides water and energy savings. Cleantex, instead, owns a type of machines that performs the water recycling resulting from its operations. Since many of these technologies are automated systems, they reduce the manual work performed by the operators and increase the quality of the products by reducing the human errors. The software innovation implemented by Cleantex made the processes more automated, and improved the repeatability of the recipes and the internal traceability of the processed products.

Since the companies' activities include dyeing and laundry, all the three companies own an internal water purification plant, which treats the waste water and which is continuously controlled. While Everest own a biological treatment plant which cleans the water and returns the clean water directly into the river. Cleantex and Laundry A owns an internal treatment plant which cleans the water up to a specific value and after the water is discharged to a consortium purifier for further cleaning.

5.2.3 Supporting Industries

The aim of the analysis of the companies part of the supporting industries is to identify their role and contribution in the sustainability process of the companies operating in the denim value chain and to understand in which direction is the industry moving.

5.2.3.1 Tonello

The Qualitative Research concerning *Tonello srl* has been done through an interview with the *Marketing Executive* of the company, which has an important role in the communication of company's activities and products (*see the questions in Appendix 5*).

Tonello is the world leader in garment finishing technologies which, since 1981, has contributed to the success of Made in Italy all over the world. Among its products it claims washing and dyeing machines - both for sampling and for production, and technologies for finishing the manufactured garment in general. All focused on the ease of use, sustainability of processes and of the working environment and on the safety of the operator and the final consumer. The company is located in Sarcedo (Vicenza) and with over 8000 machines sold worldwide, it is considered the reference point for the garment finishing industry. The main markets for the company range from Asia with Bangladesh and Pakistan, to Central and South America, though the company is present almost worldwide.

The new technologies

Thanks to its state-of-the-art machines, the company strives to solve the most critical aspects of sustainability in the denim finishing sector. The technologies developed by Tonello allows to reduce up to 80% of water, energy and chemicals compared to traditional processes. The latest innovation developed by Tonello is represented by the so-called "*Laundry (R)evolution*" which is based only on two technologies that manage in a centralized and efficient way the entire finishing cycle, by reducing waste and optimizing the use of resources. The two technologies are:

- *Laser Blaze* which substitutes the manual abrasion processes and allows to create vintage effects in specific areas, whisker fading and rips in a fast, precise and flexible way with the action of a laser beam;
- *All-in-One-System* which performs the washing cycle by integrating together four sustainable technologies in one single machine: ECOfree 2, which uses ozone both in water and in air; NoStone® + for an authentic stone-wash effects without pumice stones; UP, which optimizes the washing processes, reducing water consumption by at least 50%; and Core (*Figure 29*), a nebulizer system that improves performance and reduces water consumption.

Figure 29: Tonello's Core Technology

source: https://www.tonello.com/it/product/core

The standard Stone Wash technique for the denim washing consists of the use of pumice stone which results to be highly unsustainable for the environment, workers and for the companies. In order to avoid all the negative costs, which have been presented in the chapter 4, Tonello developed in collaboration with Levi Strauss & Co. the *NoStone*® technology, which is also one of the technologies of *All-in-One-System,* and provides a total and removable coverage of the inside of the washing machine basket with a stainless steel "plate" made abrasive by a variable treatment according to the desired effect. Due to the mechanical rather than chemical

nature of the process, the NoStone® effect is the same as that of stone-wash and almost entirely eliminates the carbon footprint of pumice stones. Indeed, the process reduce the use of water, production costs, emissions and processing time. In addition it produces neither dust nor sludge, it does not damage the garment or the washing machine and it creates a uniform effect both on sampling and production machines.

For the dyeing process, the company developed the *Wake system* which is the first totally natural dyeing system that uses plants and vegetable waste without chemical auxiliaries harmful for our health. Wake can be installed on any Tonello machine, both for dyeing and washing, to obtain unique and personalized effects. The benefits of using the Wake system consists in using 100% organic and compostable raw materials, making the process circular, reducing the CO_2 emissions as well as water and energy savings and in ensuring the safety and the healthiness of the dye and dyeing process for the operators and for the end consumer.

Industry 4.0 technology

The company tries to implement the industry 4.0 in the garment finishing equipment. It developed several software to achieve this goal and to facilitate the control of the processes. For instance, the *Netwash software* allows to connect to the machines directly from a personal computer to monitor the status of the machines, to create remotely new washing recipes and to manage the reports produced by each machine, and to organize the maintenance operations. *Mago,* instead, is a remote assistant service that allows the company to be close to its customers and to intervene promptly to adjust the operation issues or to prevent them. With Mago, the company can carry out timely diagnostics and adjust the operation parameters and constantly monitor production and machine reports in real time. All the technologies developed by Tonello can be connected by a software called *Metro*, which processes real data in real time to monitor the consumption of water, energy and time during a laundry process. This implies that everything can be measured with this software, from laser, washing, dyeing to drying. Besides being an industry 4.0 technology, it allows the traceability of the sustainability indicators and the transparency of the processes developed which allows to determine the sustainability performance of a process or product. Metro is able to provide reliable data, since they are automatically taken from the machines, without any manual manipulation by the operator. It delivers authentic data about the consumption of water, energy, steam and time of all the machines, the lots and even of a single garment. It automatically generates a report for each garment, with all the consumptions and a carbon footprint calculation. In the end, Metro provides a rating (green, yellow, red) for each resource, following pre-set ranges decided by

the clients, which are also part of the report. Based on the data and information provided by the software and reports, it allows to optimize the processes, enhance the sustainability and quality performance and to improve its productivity.

In developing all these technologies, the company works alongside with its customers, in order to understand what are the sustainability requirements of the market and to translate them in technologies, creating a link between the brands and the companies that work, dye and treat garments. However, the company tries to be always forefront and to invest in R&D and innovation to exploit and provide completely new solutions that could push the denim production towards a more sustainable approach.

Sustainable practices

Sustainability is not only what can be achieved with Tonello's machines, but it is also incorporated in the machines themselves. All the machines are, in fact, made 100% in Italy, with local suppliers and local employees. The short value chain translates into the reduction of emissions resulting from the transportation processes. Furthermore, the entire assembly department is powered by solar panels, installed more than 10 years ago. Indeed, on the occasion of ITMA[13] 2019, the company has been awarded with the "Green Label", which represents an award not only for the contribution to sustainability, but also for the transparency of the provided data which present an overview of the eco objectives such as energy and water savings, reduction of chemicals and circular economy, achieved with the technologies developed by Tonello.

5.2.3.2 Zaitex

The Qualitative Research concerning *Zaitex* has been done through an interview and discussion with the Marketing Manager of the company which has an important role in communicating the technologies developed and provided by the company (*see the questions in Appendix 6*).

Zaitex is a company founded in 1974 which deals with the marketing of dyes and auxiliaries for textiles, leather and for other types of surfaces such as plastic, glass and wood. The company has recently entered the denim sector, by exploiting the four decades experience consolidated in the textile industry The company's headquarter is in Povolaro di Dueville (Vicenza) and it

[13] ITMA is the international exhibition of textile machinery where the industry converges every four years to explore new solutions and ideas and collaborative partnerships for growth (ITMA, n.d.).

owns four offices in Italy, two of them dedicated to the textile and leather world. The company has a part of the internal production for the auxiliaries, whereas the dyes are not produced internally but are just marketed by the company. Zaitex's customers are mainly industrial laundries and dyeing companies and textile production plants located all other the world. The company mainly covers the Middle East, South-West of Asia (Bangladesh, Pakistan), North Africa (Tunisia, Egypt), all the Europe, Central America and South America markets for the textile area. Everest, the laundry company part of this research is one of the clients of Zaitex.

The company owns a R&D garment laboratory for garment dyeing and denim finishing which continuously develops and tests several products to be distributed. It is cutting-edge laboratory equipped with a solar panel supply system which produce electricity for internal use and a water recycling system which allows to reuse in the dyeing process the waters from previous processes.

The sustainability is increasingly requested in the chemical industry, even if it is difficult to understand what sustainability really means for chemical auxiliaries. The Marketing Manager of Zaitex claims "*Talking about chemical sustainability is a bit of an oxymoron to let you perceive something that is not sustainable in nature*". Therefore, for a chemical product to be sustainable implies that it is not harmful for the health of who enters into contact with it and it allows to optimize the use of resources.

The eco-friendly chemical aternatives

The company provides several products applied in different steps of the laundry and treatment of denim that are deemed as eco-friendly:

- An *enzyme* that works at 30 degrees, and therefore could be considered more eco-friendly as is allows to perform a phase of the process at a low temperature, without using any other resources to change the water or to make another type of enzyme work at higher temperatures;
- An *ozone activator* that allows the bleaching of denim garments by activating the abrasive power of ozone on the garments dyed with indigo.
- APJ system is an ecological alternative for the bleaching of indigo and sulfur dyed garments to be applied by spray or machines. It represents a substitute for potassium permanganate, a very dangerous substance used for bleaching and it allows the laser to work less.

By employing these products in the three specific processes, it is possible to reduce the production time and temperature of a process and to replace harmful products with more eco-friendly alternatives.

For the abrasive activities, the company delivers the "Bio-treatment" products, which represent eco-friendly innovations for the stone wash and are distributed exclusively on some markets (Italian and Asian). The Biostone and Biorubber is an ecological alternative of the classic pumice stone used in the traditional Stone wash. Whereas Biosponge is an innovative-creative solution to provide a soft hand to the denim treatment or garment dyeing post-treatment.

The innovative solutions created and distributed by the company, influence not only the use of resources used in a washing cycle, but also the effects that could be obtained on a denim garment, though they are evident mostly to the technicians of the laundries and not to designers.

With regard to the innovation process, the policy of the company is to make the continuous R&D activity both on the basis of the inputs and specification received from its customers, but also very often on studies done internally which propose new products. The company created the Zaitexfashion project with the aim to act as an intermediator between its main customers – the industrial laundries, and the brands that commission the work to laundries. However, Zaitex does not perceive any benefits in terms of innovation deriving from the location in the denim district. Most of the times, the requests are coming from the foreign denim market such as Pakistan and Bangladesh due to their recent development.

Sustainable practices and traceability

The company is committed to provide products which comply with the current regulation and to continuously improve the environmental and social sustainability of its products to be able guarantee customers the best responses to every request made. Although Zaitex is not producing all the auxiliaries it distributes, it is performing many studies and controls on inbound and outbound products to be sure that they are complying with the regulations. The company tries to keep short stocks, in order to avoid the sale of old products which can be dangerous. Moreover, the internal quality certification ISO 9001 provides a quality system which is annually renewed in all the plants and on which is mainly based the Corporate Social Responsibility of the company. The system provides Zaitex with a code of conduct which covers all the operations of the company, thus most of the activities performed to respond to the requests of its customers are based on this quality system. From an environmental point of view, the company is committed to deliver products that comply with the current regulations and it strives to obtain a continuous improvement in this respect.

With regard to traceability, Zaitex developed an internal software that enables to trace all its products internally, independently whether it is a dye or an auxiliary. The traceability starts from the source up to the delivery of the product and the application of the product by the customer.

Drivers and barriers

The drivers for sustainability faced by Zaitex are both internal and external. The marketing Manager claims "*for us it is more a driving force dictated by the market, accompanied by the fact that the vision of the company has always been that of not necessarily selling what specific chemical product, but trying to optimize the production cycles*." Therefore, as stated before, the company owns a R&D laboratory which is in charge of the constant development of new dyeing recipes and washing processes and on continuous optimization of the use of resources in a production cycle.

Nevertheless, the company is feeling an increasing pressure for sustainability from the market. In the denim sector, the sector which is quite recent for Zaitex, the approach of the customers is to always ask chemical suppliers whether their products are certified or not. Although the company has not undergone any audits from the brands, it receives many requests from brands which usually rely on their own RSL (Restricted Substances List) or on the adherence to a particular certification. "*For denim, we know that probably, having products conforming to GOTS or Bluesign is what the customer and the market ask us the most"* underlines the Marketing Manager. In order to face the pressure for certification, the company, in fact, has achieved the GOTS certification which implies that it approves a list of products for the application to the treatment of organic cotton. Its intention for the 2020 is to achieve also a Bluesign certification, which is one of the most requested in the denim market. The requests on brands RSL specification come both in a direct and indirect way. For instance, if client of Zaitex works for a specific brand such as Levi's, then the requests coming from Levi's about the substances to be avoided reaches indirectly also Zaitex.

As a criticality highlighted in the interview is represented by the market of certifications, which requires the company to multiply its efforts and financial resources to be able to follow the certification market. Therefore, in this case a drivers could translate also in a challenge for the company sustainability approach. Another challenge is the price-driven approach of the brands. "*It can happen that a price policy still wins compared to that of the truly eco-friendly constructive value chain*" states the Marketing Manager of Zaitex. This highlights that sometimes the efforts and the resources of the company dedicated towards producing and

delivering sustainable products, that optimize the resource usage and safeguards the operator who applies such products, are not paid off.

5.2.3.3 Cross-case analysis of the supporting industries

After the within-case analysis of *Tonello*, specialized in garment finishing technologies, and *Zaitex* a distributor of chemical products for the textile industry, in order to have an overall picture of the supporting industries, it is necessary to do a *comparative analysis* of the companies. First of all, it is important to highlight that the interview with Tonello is focused more on the range of products developed by the company, thus on the technologies and innovations introduced into the market. Whereas, the interview with Zaitex is focused in addition to the innovative solutions provided into the market, also on the sustainability practices of the company. Unlike a technology manufacturer, a chemical company faces more stringent regulations and requests from the market in terms of sustainability standards. Therefore the comparative analysis will be performed mostly with regard to the sustainable technologies and solutions in the denim sector, whereas the sustainability practices of the chemical company will be used in the global analysis of the denim value chain.

The role of technology

By analyzing the interviewed companies part of the supporting industries in the denim value chain, it is possible to perceive their significant role in the sustainability path of the Italian denim sector. Therefore, by combining the technologies developed by Tonello and the products developed and distributed by Zaitex, the industrial laundry and dyeing companies have the opportunity to perform sustainable processes and to guarantee the safety and healthiness of the dyeing, wash and the garment, for the operators and for the final consumer, as well as to be more efficient and to be able to meet all their customer's needs and requests.

In addition to sustainability, the technologies developed by Tonello enables the traceability and transparency of the denim value chain. The company developed several software part of the industry 4.0 technology, which can be applied to every Tonello's machine and which improve the control and provides real-time traceability of the inputs used and of the entire production cycle.

Therefore, companies performing finishing activities can reduce the consumption of resources such as water, energy and avoid harmful chemical products throughout the supply chain and this can be done by investing in the latest technologies and solutions. Obviously, the investment

capacity of the companies will depend on the company size, availability of financial resources, approach to sustainability and internal or external pressures.

The innovation process

With regard to the innovation process within the investigated companies, it is both a demand pull and technology push process, based on the needs and requests of the market and clients as well as on the company's desire to exploit the available technologies by proposing new alternatives to the customers. Tonello tries to work with its customers and to listen to their needs and requests, but above all trying to look beyond and to innovate and provide completely new solutions. Also Zaitex is involved in continuous R&D activity based on the inputs received from their customers and the market, and on the studies performed internally. As a result of this innovation process, the two companies are creating a link between the brands who commission the garments and the companies that treat and create the effects on the garments on behalf of these brands. Zaitex, in fact, created the *Zaitexfashion project*, which is an "R&D laboratory for fashion trends", with the aim of providing their customers with an expertise in the textile market and the development of customized recipes to obtain the latest fashion effects on garments.

Sustainability approach

Based on how the companies incorporate the concept of sustainability within their technologies and solutions and how these technologies allows their customers to be sustainable, a sustainability approach can be identified.

Tonello's sustainability approach can be deemed as a ***value seeker approach****;* the technologies developed by the company do not allow only environmentally sustainable processes, but they go beyond and allows to achieve a *circular processes* without chemical additives and a *fully traceable and transparent process* which provides all the resource consumption and carbon footprint of a processed garment. As a result of these approach the company have been awarded with the ACIMIT Green Label as the "*company that has made the greatest efforts to exploit all the features and tools of the Green Label generation, producing numerous labels for different machines and updating them over time, in order to communicate up-to-date information about the sustainability path undertaken*".

The approach to sustainability of Zaitex can be considered as ***proactive***. Through the creation of the Zaitexfashion project, the company is developing chemical auxiliaries, specifically designed for denim garment finishing treatments, to optimize the use of water, decrease the waste water resulting from the production processes, enhance resource usage and the overall

results of the processes. The proactive approach of the company is driven by the internal drivers such as the willingness of the company to always strive to search for solutions that reduce the environmental and social impact as well as external drivers such as regulations and requests from the market.

5.2.4 Project Officina Creativa

The Qualitative Research concerning *Project* has been done through an interview and discussion with the *Owner* of the company which has an important role in promoting and managing the sustainability within the company *(see the questions in Appendix 7).*

Project is a company located in Zanè (Vicenza) which produces denim clothing for luxury brands, offering the service of managing the entire production cycle. Project covers the prototyping and sampling phases within the company, whereas for the phases of the production cycle it relies on external laboratories who perform the activities from cutting, sewing, to printing and finishing activities. The company's target market is that of the luxury brands and among the clients of the company there brands such as Valentino, Etro, Armani and Golden Goose.

Environmental and social sustainable practices

The company is very committed to sustainability in all its forms. With regard to the social sustainability of the territory, Project undertakes actions such as the creation of internships, collaborations with institutes, supply of end-of-series materials for schools and kindergartens, organization events and meetings as well as the exposition of works of arts within the company. The social sustainability is manifested through the establishment of mission, vision and values that are aiming at the creation of a corporate welfare plan for the workers. The activities performed by the company have a low environmental impact, as it has not particular emissions, consumptions and discharges or use of hazardous substances. However the company pays attention to the waste collection and to the reduction of the use of resources. Nevertheless, Project pays great attention to sustainability when selecting its suppliers. It is sourcing certified raw materials which are provided by companies that respect both ethical and environmental sustainability requirements. Moreover, the suppliers of raw materials are controlled for the chemical safety of the products they are offering, in order to avoid the use of hazardous chemical products.

Traceability

Project can perform an internal and external traceability of its products by employing a management system that allows to monitor the progress of the products and to manage the entire production cycle. The management software contains information regarding each manufactured product, each phase that it must undergo by whom it was made and when, both incoming and outgoing. Therefore, it is all perfectly traced. Moreover, some of its suppliers can access the system and enter data, although it cannot be considered a real Supply Chain Management system.

Drivers and the role of brands

The drivers that push the company to become sustainable are both external and internal. Initially the drivers were external, coming from brands requests and audits. The brands are verifying whether the value chain used by Project respects the requirements of social and environmental sustainability and whether it is certified or not. "*If you don't have this type of supply chain, you won't even start working with this type of customer*" claims the Owner of the company. Moreover brands are providing formal guidelines and procedures in the form of Code of Ethics or Conducts necessary to produce their products, which are displayed at the Project's plant and its suppliers' plants. Another external driver was the collaboration with the University of Venice, where the company participated at a project concerning the corporate responsibility and where it had the opportunity to learn the principles of social sustainability. The internal driver has risen as a result of this collaboration. Therefore the company has made the sustainability part of its current business strategy, as it understands that for a future in this sector and territory it is essential to embrace the sustainability requirements, because otherwise the companies will be out of the market. Thus, the sustainability part became the real philosophy of the company.

The Company Owner states that at a product level there are no specific requests from brands concerning the environmental issues. *"We are still not asked to use organic cotton, or to make treatments to wash jeans that do not use water, but only high technology"* states the Owner of the company. Therefore, the suppliers are acting on the environmental issues such as saving water, energy, resources, waste water treatments, but it is not yet explicitly requested that the product developed reflects these concepts. Even if these requirements are not explicitly required into a product, the suppliers should act on them as they are always monitored through the audit. Indeed, the audits monitor the presence of a waste water treatment plant, application of Code of ethics, respect of people, etc. Furthermore, the environmental impact from the point of view of LCA in the design phase of new products is not yet taken into consideration by brands and

as a consequence those who develop products and are researching materials are not focusing on this theme.

The company undergone several audits submitted by third parties on behalf of brands who certify the conformity of the company with the rules determined by the brands. The audits monitor the ethical aspects, the conformity with the legislation regarding the products standards and taxes, all the aspects of product safety in terms of chemical safety and color solidity. The audits applied to Project imply that also their sub-contractors are submitted to the same audits, hence both Project and its sub-contractors have to comply with all the requirements. And even if a brand is not applying an audit, since the brand audits are quite similar and if a workshop submitted an audit from a certain brand, it automatically implies that these workshops are complying with what requested by an audit.

Sustainability approach

The approach of the company towards sustainability is a **value-seeker approach.** In such an approach, the implementation of sustainability does not stop at company borders but extends to suppliers. The company is monitoring the sustainability performance of its suppliers and from the year 2020 it will start to perform the pre-audits on its suppliers. Indeed, for doing this, Project did a training in order to obtain fairly well-understood audit concepts to be applied on its suppliers. The variables on which the company is focusing when monitoring its suppliers are mostly linked with the social aspects, such as : the code of ethics which includes the respect of the people, working hours, wages and employee's wellbeing; and the conditions of the workplace such as fire and evacuation rules and medical examinations. For the suppliers that perform wet processes and that have an environmental load, there is also a control of the water treatment plants, CO_2 emissions and resource savings. The supplier of raw materials, instead, are monitored over savings, emissions as well as the recycling of production residues.

The proactive and collaborative approach of the company is shown also in the creation of *Ghost Makers project*, which aims at making more transparent and traceable the Italian workshops and to give them the opportunity to interact directly with the brands. Indeed, for the Owner of the company the traceability of the value chain and its transparency represent "*the only goal that this type of supply chain should have, because without this it makes no sense to produce in Italy*" and "*it is the only reason to be able to provide products made in a sustainable and traceable way*". Therefore, the traceability of the value chain is considered a strategic and fundamental element in the current context of the Italian fashion system. The idea of the Ghost Makers project was born out of a need of the company to know who are the workshops that

could carry out an audit and to become certified and in this way making them traceable and known to the market. By doing this, Project wants to support the workshops making them traceable and giving them the possibility to continue their activities, which in turn translates in the wellbeing of Project, as its activity depends on the existence of workshops in the territory.

5.3 Discussion

After the individual and cross-case analysis of each phase of denim value chain, in order to have an industry level overview, a global analysis is performed which takes into consideration all the players of this study, including the denim garment manufacturers part of the quantitative analysis.

5.3.1 Drivers for sustainability in the Italian denim value chain

For what concerns the main drivers leading to undertake a sustainability approach (RQ1), the analysis highlights the presence of both *internal* and *external* drivers for sustainability in the upstream phases of the denim value chain. In particular, the predominant drivers that push on the majority of the sample firms towards the implementation of sustainable actions and practices are mostly external and consist in the *requests from the market and brands*. Brands are increasingly asking their suppliers to reduce their social and environmental impacts, by submitting them audits. Moreover brands are providing formal guidelines and procedures in the form of Code of Ethics or Conducts necessary to produce their products. However, their requests are in general related to the production process performed by suppliers and not to the product itself. These drivers tend to be more evident in the phases of the value chain which are directly in contact with the brands, mostly the first and second-tier suppliers that provide the raw materials and manufacture and process the finished goods. The requests from brands tend to be insignificant or quite inexistent for the suppliers of semi-finished goods such as yarns producers. As highlighted by the literature (Ditty et al., 2019b), being its activities at the very beginning of the value chain, brands may not have any direct contact with them and may lack visibility in the value chain. Therefore, this shows that the drivers from brands or market for sustainability are not perceived at the beginning of the value chain. Moreover, at this level of the supply chain, the production processes tend to have a low environmental impact and therefore the attention of the brands is lower.

Other external drivers identified are the *legislative pressure* which is shrinking both environmental and social tolerance parameters, as well as *pressure from NGOs* (ex. Greenpeace) who require specific compliances with the standards and *multi-stakeholder groups* such as the ZDHC Programme. Indeed, some of the analysed companies are part of DETOX

and ZDHC and continue their commitment towards a sustainable industry. In contrast with the literature, describing government regulation as one of the leading pressures for sustainability in developed countries (Lozano, 2015), the current study finds that although the Italian legislation is very stringent, the suppliers do not regard it as a major push for sustainability. It is rather perceived as something that they have to comply with for the regular activity of the business and most of the analysed companies (Berto, Candiani Denim, Everest, Project, Zaitex, Laundry A and some of the garment manufacturers) are going beyond the legislative requirements.
Consistent with the sustainability literature which identifies the collaboration with institutions crucial in supporting and motivating the small size firms (Lozano, 2015), this study finds that the *collaboration with universities or other institutions,* as in the case of Project, was an important step in rising the awareness and the knowledge of the company regarding the sustainability.

Internal drivers are associated with the *efficiency benefits* deriving from the decrease of the use of energy, water, production time and less use of resources. This driver has been mostly highlighted by Manifattura di Cene, which has not felt any external pressure from its customers and voluntarily adopted some practices to reduce its costs. More importantly, the internal drivers of some suppliers were linked to the *ethical leadership and consistency with the company's and management's vision and values* as in the case of Candiani Denim, Berto, Everest, Tonello and Project, whose management perceive sustainability as the only winning strategy for the future of the company and a fundamental element to move the denim industry towards a more sustainable one, by setting new technical standards. Another internal driver is represented by the opportunity *to increase the value of the products* offered and to s*trengthen the market position of the company*. In some cases, also the *location of the company* could be considered an internal driver. For instance, the location of Candiani Denim in a natural reserve leads to a complex legislative pressure for the firms to be conscious of how its activities impact the environment and society.
Most of the times, drivers do not seem to act in isolation, thus a company's sustainability approach may be driven by the internal and external drivers at the same time, as in the case of the majority of the companies part of this study. And some drivers, especially the ethical leadership and values can prevail over the external drivers and mediate their influence.

According to most of the interviewed experts, among the actors that most promote the sustainability in the denim value chain are the brands, who try to manage their supply chains, by pushing for requirements compliance, and the producers of raw materials such as yarns,

chemicals, machineries and fabrics who offer new and more sustainable raw materials and techniques.

5.3.2 Sustainable practices in the Italian denim industry

The presentation of the main sustainable practices developed and implemented by the upstream suppliers in the denim value chain (RQ2), will be divided into three levels for a better understanding: *product, process* and *value chain* practices.

5.3.2.1 Product sustainable practices

Among the denim value chain sustainable practices related to the product emerges the use of *certified and sustainable raw materials*. Indeed, all the suppliers of raw materials and inputs such as yarns, denim fabrics, chemicals, are certified suppliers. All the analysed yarn and denim producers are using a percentage of *certified organic cotton* into their yarns and fabrics. Moreover, a selection of Candiani fabrics are made using 100% organic cotton in compliance with the GOTS. The chemical producer Zaitex, distributes a list of products certified GOTS for the certification of the organic cotton and adhere to the restricted substances list (RSL) of the brands. In addition, Berto and Candiani Denim are also using cotton grown, produced, and marketed according to BCI standards. All the companies involved in the yarn and fabric production which are Manifattura di Cene, Berto and Candiani Denim, are employing *recycled cotton* yarns which derive from the cotton waste recovered from the production processes and spun into GRS certified yarns. Whereas the shredding and spinning processes of the recycled cotton of Berto and Candiani are carried out by external companies, Manifattura di Cene performs it internally. Companies are also employing sustainable fibers such as Tencel, Refibra and Roica.

Consistent with the literature, as a result of the pressure coming from NGOs and multi-stakeholder groups, chemical management became a key concern across the denim producers (Ellen MacArthur Foundation, 2017). For instance Berto committed to Greenpeace's Detox and REACH protocol, and Candiani Denim - to the ZDHC Programme to guarantee a continuous control process and responsible chemical management which ensure the product safety and the safety of those who enter into the contact with the denim fabric. Zaitex, instead, created the Zaitexfashion laboratory to develop and test eco-friendly alternatives to the existing chemicals for the textile producers, which allows their clients to save valuable resources, to use less chemical auxiliaries and to avoid the creation of hazardous working environments and water pollution. These companies are increasingly engaged with material assessment and the control of the chemicals and waste water. Furthermore, Berto and Candiani are employing in the dyeing

of yarns only certified *pre-reduced indigo*, which, compared to the traditional indigo powder, reduces the use of sodium hydroxide use by 52%, and sodium hydrosulphite use by 63% - two chemicals commonly used to help fix indigo dye to cotton fibers (Candiani Denim, 2019). Moreover, Candiani Denim employs dyes made from elements found in nature such as nutshells, orange peels, rosemary, etc. and a polymer derived from recovered shrimp shells as a substitute for the poly-vinyl alcohol which is a water plastic pollutant.

Although the analysed companies are implementing several practices at the product level, the owner of Project states that the requests of the brands are not explicitly connected to the product, thus the suppliers are not specifically required to use only organic cotton or other sustainable raw materials. This implies that the sustainability practices developed by the suppliers at the product level are implemented by them based on their internal awareness and industry dynamics and are anticipating the potential future requests coming from the market.

5.3.2.2 Process sustainable practices

The sustainability practices applied to the operation processes emerge mainly in terms of water and chemical management, workers safety, health and wellbeing, energy efficiency and consequently the reduction of CO_2 emissions. Companies are monitoring and tracking their water and energy consumption and CO_2 emissions; some of them daily or weekly, others monthly or annually. By monitoring their consumptions, companies are able to understand what are the critical processes that require actions for improvement.

Water and chemical management emerged as a key concern for the companies performing wet activities such as denim producers, laundry and dyeing companies, and the chemical supplier, due to their significant role in the companies' processes. They are carrying out several R&D activities and invest in innovative technologies and techniques to upgrade their processes and to enhance the wellbeing of their operators. The denim producers (Candiani and Berto) and the laundry companies (Everest, Cleantex and Laundry A) are committed to environmental impact reduction of the surroundings of the company through the presence of an internal waste water treatment plant, which treats the waste water partially or completely. Innovative technologies combined with the chemical reduction or substitution with eco-friendly alternatives is crucial to achieve the water stewardship, which is then translated into reduction of costs associated to sludge resulting from water waste treatment. As outlined by the Manager of Everest the sludges "*go to special waste quarries. The cost is always higher each year to receive this material, as the quarries tend to close more and more. To avoid this, we try to eliminate the pumice stone".*

Moreover, by eliminating or substituting certain hazardous chemical auxiliaries such as the potassium permanganate from the wet processes, results in a reduced water consumption and enhanced waste water treatment performance. Zaitex, for instance, provides an eco-friendly substitute of potassium permanganate, therefore laundry companies have the possibility to reduce the damage created by that chemical.

As a practice aimed at reducing the textile waste, yarns and denim producers recycle and reuse the fiber and textile waste resulting from their processes. Manifattura di Cene regenerates the fiber waste into new yarns; Berto recycles the pre-industrial waste which derives from the dyeing phase; and at Candiani in all of the production departments all the waste deriving from jute bags, fiber and semi-finished products is recycled. These materials are then processed at specialized external companies becoming a variety of products (e.g. insulating material and upholstery for cars).

As suggested by the literature, damage of the industry including harmful chemicals, textile waste, labor abuses can be limited through the implementation of innovative technologies (Scaturro, 2008). In this regard, companies *replaced their technologies with innovative and more automated ones* or applied *new software to the existing technology*, which allow to reduce the production time, to improve the performance of the products, to save energy and water, to reduce the manual work of the operators, to decrease the human errors and the costs associated to the processes. Besides, the installation of photovoltaic plant or hydroelectric power plant represents another commitment to environmental impact reduction and energy-savings costs made by Cleantex, Manifattura di Cene and Berto.

Regarding the social sustainability, the process practices translate into the automation of processes and implementation of conditioning systems for the dust removal, which reduce the manual labour of workers and improve their wellbeing. The practices adopted in the production processes of the garment manufacturers are mostly related to social sustainability and regards the activities aimed at increasing the level of hygiene, health and safety of workers, training courses aimed at employee development and safety courses, maintenance of the fire prevention and electrical systems, and for the manufacturers with a value-seeker approach to sustainability also the implementation of a Code of ethics and welfare benefits to the workers. Some companies own management systems for the social aspect such as the Social Accountability 8000 which enables workers to raise their voice and to presents their concerns.

5.3.2.3 Denim value chain sustainable practices

Practices for the sustainable supply chain management include sustainable sourcing, monitoring, brand audits, application of code of conducts, inter-firm collaborations, and traceability of suppliers. Sustainability is incorporated into sourcing through the accurate screening and close relationship with the suppliers.

Brand audits are the main practices used by brands to monitor the sustainability of the denim value chain. Brand audits are carried out by third parties on behalf of brands and focus mostly on the social aspects of sustainability, such as the employer's contracts, working conditions, workplace's safety, labour standards, employee's welfare systems, medical examinations, working hours, protection gear, etc. Nevertheless, in the case of Candiani Denim, the audits focus mostly on the environmental aspects, due to its location in the Ticino Valley. However, the suppliers which are not in direct contact with the brands such as yarns producer and chemical company have not undergone any brand audits. This implies that the audits stop at the first or second tier of suppliers and are not extended further in the upstream phases to the suppliers of semi-finished products. Most of the times, these suppliers may submit the audits indirectly. Zaitex is an example in this respect; it submitted indirectly the audits applied to its clients, as is has to respect certain principles requested to its clients by the audit. The same is confirmed by the owner of Project who states that the raw material supply chain is usually not monitored, but following an audit of their clients, they are usually checked only for the areas of chemical safety whether they employ chemicals in their processes.

However, regarding the effects of brand audits, from the qualitative analysis emerges that they have not influenced the operations of the interviewed suppliers. Unlike the literature which presents the application of brand audits in developing countries and identifies its ineffectiveness in addressing social issues (Huq et al., 2016; LeBaron et al., 2017), the current study investigates companies operating in Italy, where stringent regulations exist and therefore the requirements of an audit are already imposed by the regulation, thus companies are already implementing them. Therefore, even in developed countries, the effects of brand audits are not that visible. However, the quantitative analysis regarding the garment manufacturers shows a different result; the effects of the audits are perceived differently by the workshops, depending on the level of implementation and on the type of sustainable activities within the company. This implies that for small workshops the effects are in some way correlated to the level of implementation of sustainability practices.

Certifications of raw materials and of production processes is a common practice in the denim value chain. While Cleantex, one of the analysed laundry companies, has not submitted any pressure from its clients for certifications, Zaitex, the chemical company, before entering into a relationship with a client, is explicitly asked whether it has the GOTS or Bluesign certification. This difference could be linked to the activities and products offered by the companies. The chemical management is a very crucial part of the denim value chain, thus companies are increasingly scrutinized. If the company do not own one of these certifications, clients are not starting the business with it. Likewise, Project before entering a relationship with a brand is verified whether its value chain respects the requirements of social and environmental sustainability and whether it is certified or not.

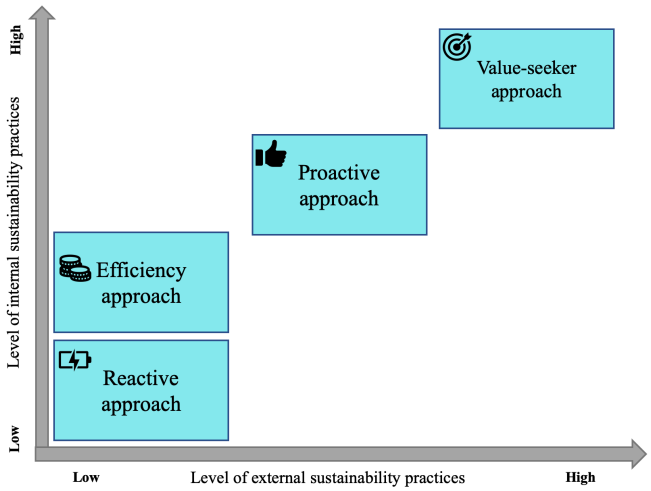
Consistent with the literature that outlines the importance of collaborations among the players of the value chain to achieve a SSCM (Garcia - Torres et al., 2019), the current study evidences several projects and collaborations performed with the aim to improve the sustainability, traceability and transparency of the Italian denim value chain. Candiani Denim, for instance, committed to the reduction of the environmental impact through the creation *of the Denim Project 2.0* in partnership with Nearchimica SpA and Centro Tessile Cotoniero and Abbigliamento SpA, which aims at identifying innovative eco-sustainable and regenerative solutions at the process and product level, in order to reduce the water and energy consumption, risks to workers and society, and waste production. Berto, instead, has a relationship with a spinning company Marchi & Fildi, which is recycling Berto's pre-industrial waste, thus reducing considerably the textile waste. Laundry A started a collaboration with Ritex laboratory to achieve the path followed by the Blue sign certification.
Preserving the Italian production of denim garments is also one of the prerogatives of Project. Indeed, the Owner of Project launched the Ghost Makers project which aims at developing the workshops that manufacture garments on behalf of luxury brands. Transforming the workshops from ghost makers into visible actors in the chain in order to make them known to the international brands and to help them to continue their activities and to preserve the labour force and craftsmanship skills at risk of dying out in Italy.

5.3.2.4 Approaches to sustainability and the challenges associated

Based on the approaches suggested by Macchion et al. (2018) and Schaltegger & Burritt (2014), the current study identified four approaches (RQ2), depending on the different levels of implementation of sustainability practices, both external and internal (*Figure 30*). *Reactive companies* are characterized by a low level of implementation of internal and external

sustainability practices at the process level and most of their practices are the result of the legislative pressure, brand audits and market requests. Thus, these companies are interested in complying with the minimum sustainability standards imposed by the legislation or brand audits. The *efficiency approach* implies that the company's approach is the result of the willingness of the company to be efficient and to reduce costs, as the company has not submitted any external pressure. The *proactive approach* of the companies is characterized by a good level of implementation of both internal and external sustainability practices and these companies are going beyond legal compliance by being proactive and collaborative within the value chain. The *value-seeker approach* are the best in class companies which invest a lot in sustainability and make sustainability part of their strategy and company philosophy, as they see sustainability as the competitive advantage in the denim value chain. Some of the value-seeker companies have been awarded with some sustainability titles. For instance, Candiani Denim, has been awarded as the "The Greenest Mill in the Blue World" due to its outstanding commitment to sustainability in the denim industry. Whereas, Tonello has been awarded with the "Green Label Award" as a company that has made the greatest efforts to exploit all the features and tools of the Green Label generation.

Figure 30: Representation of sustainability approaches followed by the analysed suppliers



Source: author's elaboration based on Macchion et al. (2018)

Most of the analysed companies started their approach to sustainability by being more efficient and reducing the use of resources, or by respecting the legal regulation and the requests coming from brands. Subsequently, proactive and value-seeker companies motivated by an ethical leadership, have continued their efforts further to apply practices which overcome the requirements and to develop projects or social sustainability systems that could provide changes to the entire denim value chain, and to motivate the reactive companies to follow the same path.

From this analysis emerges that the sustainability approaches can be different across the firms within the same phase of the value chain, showing that the sustainability path is strongly related to the activities performed by the company and influenced by the different drivers, size of the company and availability of financial resources. For instance, Manifattura di Cene does not employ any wet activities, thus its approach is limited mostly to social and economic sustainability.

Challenges to sustainability implementation

However, the different approaches could also be connected to the benefits perceived by the companies and the barriers and challenges which can hinder the level of implementation of sustainability practices. For instance, the *lack of financial resources and time* and the *lack of internal company skills on social responsibility issues* represent the most common barriers for garment manufacturers. These challenges are connected to the small size of these companies both in terms of turnover and employees. The implementation of sustainable practices requires, in fact, high investments to introduce innovative technologies, to train the resources and to change the production processes according to sustainable and traceable principles, and the companies highlight that most of the times these efforts are not paid off, as the *market is still more price-driven*. Indeed, a cited issues for the suppliers in approaching sustainability is the lack of recognition by brands of supplier's sustainable efforts. In particular, Manifattura di Cene, Candiani Denim and Zaitex complained that brands and clients are more centered on price and do not recognize any premium price for sustainable product, thus discouraging in some way the companies, especially the reactive ones, from investing in sustainability. This is even more critical if we consider that most of the suppliers of important fashion brands are usually small or medium sized companies with exiguous resources to dedicate to the R&D of new sustainable products or processes. Moreover, many times the *requests from brands are not consistent with the reality and are very confusing*, trying to push on sustainability because it is fashionable today, even if they have no technical knowledge about it. Therefore, it becomes very challenging to satisfy the requests coming from some brands. The *Greenwashing effect* is another barrier that hinders the sustainability development and it is a result of the lack of transparency in the fashion industry.

Another barrier emerging from the analysis is represented by the *lack of a general certification* and universal norms for all the sustainability aspects. The suppliers have to follow different Certifications and Standards in parallel for various sustainability aspects, and it becomes

complex, confusional and time consuming to manage all of them together in dealing with sustainability. This aspect has been highlighted by Candiani Denim, Berto and Zaitex. Another challenge is related to the difficulty to keep pace with the fast changing markets and with all the innovations that are emerging. Furthermore, Laundry A complains that there is no a clear path established which could state what should a company do to become more sustainable and this in some way slows down their development. The *composition of dyes or chemical auxiliari*es could be another barrier to sustainability implementation as they contain several salts that challenges the treatment of waste water and its further re-use. Also the *limited availability of sustainable alternatives* on the market challenges the companies' approach to implementation. The existing alternatives are very costly and exist only in limited quantities and range, therefore they do not allow a fully sustainable approach.

Therefore, the strategic approach to sustainability of the companies depend on the ability to consolidate the drivers that push companies towards sustainable practices and to face the barriers or challenges that hinder their implementation.

5.3.3 Traceability and transparency of the denim value chain

The literature shows that promoting traceability and transparency in the value chain is very important for SSCM, due to the fragmented production and its articulation among many suppliers and subcontractors, as well as to the social and environmental sustainability issues and opportunities associated to their activities (Marconi et al., 2017; Kumar et al., 2017b).
From the current study emerges that most of the companies are efficient to perform an *internal traceability of their products and processes* (RQ3), in order to know the state of the processed products and to be able to provide to their clients information about the state of their orders. Nevertheless, the internal traceability of the majority of the garment manufacturing workshops is very poor, as they do not own any tools and technology which allows to trace the internal progress of the products. Only two workshops out of 18 are owning tools, such as *Remote control* and *Personal computer integrated with the electronic machine control units*, that allow the internal traceability of products they manufacture. The poor traceability within this stage of the denim value chain could depend on the small size of the companies which often results in a workshop structure, limited financial resources and the limited technology capacity.

The study shows that the development of traceability is mainly supported by the integration of tracing and tracking capabilities and tools such as *Management Systems* (from the simplest

record-keeping mechanisms to complex RFID tags) or additional *software* and traceability innovations that allow to trace all the products, processes and the sustainability performance. Some companies such as Candiani Denim and Project are able to trace also their suppliers, as they have close relationships with most of their suppliers of raw materials and the latters are located in the same area. For instance, Project possess a management system which allows to trace information regarding each manufactured product by whom was made and when and, in addition, some of its suppliers can access the system and enter data. Moreover, Candiani Denim is evaluating the use of RFID tags for cotton and the implementation of the Blockchain technology. Cleantex is able to trace its suppliers of chemicals based on the invoices received. With regard to the raw materials, all the companies producing yarns and denim are able to trace the organic cotton, thanks to the transaction certificate which guarantees the provenience of the cotton and which is applied to every phase of production chain, hence it is completely traceable. The conventional cotton and the BCI cotton is more difficult to be traced up to the farmers; Candiani is able to trace this type of cotton up to the ginner.

The study highlights that companies are able to trace and measure the environmental and social impact of their operations to ensure transparency and improvement. By employing Supply Chain Management systems Berto and Candiani can track the use of water and chemicals, energy and CO_2 emissions of their production processes. Everest, instead, owns a software *EIM (Environmental Impact Measurement),* which measures the amount of *water, energy, labor* and *chemicals* consumed during a specific treatment and it helps Everest and its customers to understand how much impact the washing has on the environment. The companies that do not own any management system or software are monitoring regularly the consumption of energy, water, CO_2 emissions, waste, therefore they can track their environmental and social impact. However, in most of the cases the traceability of the impact and of the environmental performance is not a real time traceability, but can be performed only after the process is finished and the total consumption of the production batch measured. These type of impact measurement is not considered a LCA of the processes or products; for the LCA is needed a more integrated and smarter system which enable the real time traceability. However, the research shows that in the industry advanced technologies exist, which enable the real-time traceability of the denim value chain and facilitate the disclosure of detailed information about operations, sources and impact. For instance, Tonello developed several software part of the industry 4.0 technology, which can be applied to every Tonello's machine and which improve the control and provides real-time traceability of the inputs used and of the entire production cycle. The **Metro software** processes real data in real time without human manipulation, to

control and monitor all the laundry consumption and to improve the productivity and the performance, based on the data provided by Metro. Therefore, the integration of Metro with the machines facilitates the real record keeping and the information tracking of the processes throughout the denim finishing activities.

The availability of this information could be very valuable for brands to increase the transparency and traceability of the denim value chain, and to add more value to their garments. Brands can have the possibility to have a full overview of the sustainability issues of their value chain and to enhance its transparency concerning the sustainability performance of their suppliers. Although the companies are able to trace and monitor the environmental and social impact resulting from their activities, this information is not always required by brands or communicated to them. Nevertheless, if in the case of Everest and Berto this information is requested and communicated to brands and brands are improving the value of their products based on this, in the case of Cleantex, this data is not requested by brands and hence not communicated to them.

Regarding the communication of sustainability performance, some companies claim that brands are increasingly communicating the sustainability performance of their products and the fact that the garment was processed with eco-sustainable technologies to enhance their brand reputation. Whereas, others state that the willingness of the brands to publish this information is quite limited and even those who want to trace their value chain and to communicate it to their stakeholders, they usually end up at the fabric level. This is line with what outlined by the literature (Ditty et al., 2019) , which states that usually brands trace only their first-tier suppliers. However, brands are more prone to publish the name of suppliers which are well-known in the market or to the end consumers as producers of sustainable products, because in this way the traceability can bring them benefits in terms of enhancement of brand value and reputation. Therefore, most of the times the communication and transparency level of the value chain depend on the brands; some brands may be more prone to communicate information regarding the sustainability performance of their products, others may not communicate it at all. With respect to this, the Owner of Project claims that the brands are not communicating this information and do not use it as a marketing tool "*this was done at the beginning, 10 years ago, when it was not true and it was said that it was done. Today it is a bit the other way round; you do it and you don't communicate it"*.

By analyzing the entire denim value chain, it seems that internal traceability is challenging only in the garment manufacturing phase of the chain due to small size of the companies and reduced

financial resources to invest in traceability systems. However, these suppliers are traced externally by the contractors that commission them the work, as most of the times they have close relations with them. Contrariwise, the rest of the denim value chain could be fully traceable due to the network structure of the district, which allows close relationships among the players and the collaboration with the local suppliers of raw materials.

5.3.3.1 Ghost Makers project as an enabler of transparency

With regard to transparency, the Ghost Makers project aims at enhancing the traceability and transparency of the garment manufacturing workshops located in Veneto. According to the owner of Project, traceability is strategically important in the current Italian fashion system characterized by a network structure, with several micro workshops which are today in great difficulty, due to the changes in the market. The small size of these workshops represents a limit compared to the companies activating in the other phases of the value chain. Therefore, by tracing them and making visible their know-how, creativity, technical and sustainable abilities, they are more likely to interact directly with international brands. Therefore, the project represents an opportunity to improve the image of the garment manufacturing workshops for large brands, who can start to consider them competent players for their garment manufacturing and to increase their collaboration. Based on the results emerging from the quantitative analysis, the identified reactive and value-seeker companies, characterized by a *medium* and *outstanding implementation* of sustainable practices, are suitable to be part of the Ghost Makers project and to become visible to the international brands.

5.3.4 The role of technology

An aspect emerging from the analysis related to technological upgrading (RQ4) is the relation between environmental, social and economic sustainability. Suppliers are implementing innovative technologies, techniques and solutions to reduce the environmental issues connected to their processes, however at the same time significant improvements regarding the social conditions of workers and cost-efficiency related to savings of water, energy, resources and reuse of inputs are achieved. Being able to implement such sustainability thanks to the contribution of supporting industries, such as chemical producers and producers of industrial machineries.

As suggested by the literature, the technological mediation of sustainable practices can be divided into *material* and *digital technologies* (Scaturro, 2008). Regarding the material technologies, although the textile value chain, in general, is considered labour intensive rather than technology intensive. From the current study emerges that the technology and the

innovative solutions play a crucial role in delivering a high quality product and in supporting the sustainable management and transparency in the denim value chain. Most of the times, companies adopt modern technologies for several reasons: efficiency benefits, value added processes and products, employees wellbeing, which in turn translate also in more sustainable processes and products. The innovation in technology leads to changes in the production processes and techniques. Whereas for Everest, Laundry A, Berto, Candiani Denim, Manifattura di Cene, the innovation concerned more the change of the processing techniques and machines, the innovation regarding the technologies of Cleantex was focused more on software. Since many of these technologies are automated systems, they reduce the manual work performed by the operators and increase the quality of the products by reducing the human errors.

The technologies identified in the research can be divided into three types: those focused on resource efficiency, those that allows traceability and those focused towards pollution prevention, or a combination of them. More specifically, the first one consists of all the technologies and innovative solutions that decrease the consumption of water, energy and the use of resources needed in the process, such as All-in-one-system Ozone Machine, Laser, Jet dye, Nanno Bubble, automated technologies, pre-reduced indigo, etc. The second group relates to the systems and software used to trace the products and to measure the environmental and social impact, such as the Environmental Impact measurement software, Metro, Mago and other management systems. The third group focused on pollution prevention is represented by wastewater treatment plant, conditioning system which reduces the waste, Wake dyeing system, NoStone, Bio-treatment and the eco-friendly alternatives offered by Zaitex. Some of the pollution prevention technologies are following a circular economy approach, by recycling the water used within the processes or by recycling the textile waste.

In this regard, the role of the supporting industries are very relevant. Tonello is continuously revolutionizing and proposing innovative technologies to its clients that can solve the most critical aspects of sustainability in denim. Its machines and technologies allows, in fact, to save energy, to reduce water and chemical consumption, decreasing processing times and total production costs, hence respecting the environment, society, reducing manual labor and protecting the health of operators and of those who enter into contact with a denim garment. Likewise, Zaitex offers among the range of its products also eco-friendly products to be used in different specific processes, which enable to reduce the processing times, water and energy consumption and the replacement of hazardous chemicals such as the potassium permanganate

from the processes. The list of sustainable and innovative technologies available in the denim industry offered by Tonello and Zaitex are represented in the *Table 4.*

Table 4: Sustainable Technologies available in the denim industry

Name of technology	Characteristics	Sustainability improvements
All-in-One-System (Tonello)	Performs all the laundry operations by integrating together fours sustainable technologies in one single machine: • ECOfree 2, which uses ozone both in water and in air; • NoStone® + for authentic stone-wash effects and without pumice; • UP, which optimizes the washing processes, reducing water consumption by at least 50%; • Core, a nebulizer system that improves performance and reduces water consumption.	Incresed traceability It avoids the use of pumice stone Reduced water consuption
Laser Blaze (Tonello)	Replaces the manual abrasion processes allowing to create authentic vintage effects and to create new projects with extreme ease.	Reduced manual abrasion work Improved workers wellbeing Reduced production times
NoStone® (Tonello)	Denim washing system developed in collaboration with Levi Strauss & Co. to go beyond the economic, mechanical and environmental limits of the Stone Washing process .	The process reduces water consumption, production costs, emissions, processing times and manual work of the operators It does not produce dust or sludge and does not damage the garment or the washing machine It is fast and flexible and creates a uniform effect both on sampling machines and from production It is 100% ecological, economical, clean and intelligent
Wake (Tonello)	It is a natural dyeing system, because it uses only plants and vegetable waste, such as flower berries, bark and roots, left to dry and infuse, without chemical additives harmful to our skin.	It uses only 100% organic and compostable raw materials Sustainable and circular process, without additives Reduced CO2 emissions Reduced water and energy consumption It guarantees the safety and healthiness of the dyeing, the process and the garment, for the operators and for the final consumer
Metro (Tonello)	It is a software connected to all Tonello machines and can measure all the finishing phases. This means that everything can be measured with this software, from laser to washing to drying. It processes real data, in real time to check all laundry consumption, optimize process times, improve performance. Metro gives concrete and useful information to improve productivity.	It processes real data, in real time to check all laundry consumption, optimize process times, improve performance. Metro gives concrete and useful information to improve productivity, traceability and transparency.
Special enzyme (Zaitex)	Liquid concentrated cellulase for the stone-wash process on garments	It works at low temperature, and therefore it allows to make a phase of the process at 30 degrees, without using many resources to change the water.
Ozone activator (Zaitex)	It is used in the bleaching of denim garments helping to fully development of the action of ozone during the bleaching phase of cellulose fiber garments dyed with indigo, substantive and reactive.	Reduced water consumption Less chemicals
APJ system (Zaitex)	It is an effective ecological alternative for the bleaching of dyed indigo and sulfur articles. It can be applied as a Laser Booster or as a substitute of potassium permanganate.	It is a substitute for potassium permanganate It allows the laser to work less.
Bio Treatment (Zaitex)	Consists of three eco-friendly innovations (Biorubber, Biostone and Biosponge) as substitutes for the abrasive part of the stone wash.	It avoids the use of pumice stone Less sludges deriving from wastewater treatment

Source: author's elaboration based on the answers of interviewed experts

Overall, the investigated denim industry seems to be open to incorporate new technologies in its processes, but for a real transition to sustainability, traceability and transparency it needs more smart technologies, allowing a real-time control of information. Indeed, with regard to industry 4.0 technology, the study shows that it is not that diffused among the suppliers, exception Candiani which owns robotics and advanced automation technologies, and as a consequence the technologies are not smart and do not allows a real time traceability of sustainability data necessary to determine the load of the processes on environment and society. However, from the study emerges that the manufacturers of technology are already producing several industry 4.0 technologies (*Metro, Mago, Netwash*) to be applied in the denim value chain, which can facilitate the implementation of traceability, transparency and sustainability.

The type of innovation to be implemented most of the times are set in collaboration with the clients, though Tonello and Zaitex try to be one step forward the requests of their clients or brands, and to innovate continuously proposing new technologies and solutions to their

customers. Thus, most of the times, clients are involved in the innovation process, by providing specific requests coming from brands or market or specific internal requests, by testing the products or contributing with technical knowledge to a complex innovation process. However, in the case of Zaitex, the presence in the Denim district does not provide any benefits in terms of innovation. As the Marketing manager states "*Very often the requests we had, came in conjunction with the developments in Pakistan and Bangladesh"*. For the chemical company, the innovation process and the R&D of new solutions is influenced and at the same time bordered by the RSL of the brands, which impose the products to be avoided into the market.

As stated before, the denim industry distinguishes for the ability to reinvent always the effects on denim, thus denim is a fabric which is never ending (Amutha, 2017). In this respect, the study highlights the role of the technology and innovative solutions in creating new effects on denim and in terms of final aspect of the garment. And at the same time, the type of effects to be created influence the innovation process of the new technologies. For instance, the return of the 80's iconic effect is characteristic of stone-wash which now is substituted with NoStone technology or other abrasive technologies. However, in the case of the manufacturers of garment finishing technologies, this correlation is more evident, with effects that creates new styles, whereas in the case of chemical solutions this correlation is evident only in the eyes of those who treat the garments and less in the eyes of designers or customers.

With regard to digital technology, the study reveals the adoption of these technologies depends mostly on the company size. For instance, the garment manufacturing workshops present a poor implementation of digital technologies. Only three companies out of 18 have a website and just two of them own social profiles to communicate their activities. Larger companies, such as Candiani Denim, Berto, Zaitex, Everest, Project, Laundry A employ websites, social media such as Instagram and Facebook to promote their sustainability approach and to increase the transparency related to their processes.

5.4 Implications, limitations and future developments

5.4.1 Implications for brands and suppliers

The research highlights mostly an satisfactory and high level of internal awareness among suppliers regarding the issues and relevance of sustainability; this awareness leads, in the majority of cases, to a proactive and value-seeker approach and commitment. Since sustainability can be considered a variable of high quality and as the clients of the analysed suppliers are for the majority premium and luxury brands that are focused on delivering high-

quality products, knowing that their suppliers are aware about and committed to sustainability, can help brands to prove the added value and the quality of their products. However, in many of the surveyed companies, there was a general perception of a not sufficient commitment to sustainability by brands. Indeed, the brand owners are criticized to be still more price-driven and to not compensate the efforts of those companies that behave in a sustainable and responsible manner. Without an adequate remuneration and consistent requests, brands cannot motivate their suppliers. Based on this findings, an implication for the brands is to be prone to pay a higher price for sustainable and high-quality products and to support the pursuance of the sustainable practices adopted by its suppliers. Since most of the companies are small size, they lack financial resources to invest in all the sustainable solutions, thus brands should not only ask requirements, but also try to be involved in the collaboration with their suppliers to develop and implement together innovative and sustainable practices. In addition, brands have to create a market for sustainable products; if customers, brands and retailers do not request it, then supplier actions and practices will be in vain. As most of the small suppliers depend on brands and their demand for certain products, the sustainable products should be absorbed by brands.

From the study emerges a difference between the social and environmental practices implementation. Since all the companies are located in Italy, the issues related to social sustainability are not very impactful. The laws and regulations in force in Italy in the field of working conditions, workers' rights, avoidance of child labour are very advanced and stringent, especially when compared to those in place in countries with low labor costs. Consequently, the achievement of satisfactory levels of social sustainability coincides with legislative compliance. Indeed, at the beginning, the brand audits were focused more on social issues; now, they are increasingly focusing also on environmental issues, especially at those suppliers that use high quantities of water and chemicals and produce hazardous waste.

The environmental sustainability implementation and performance, instead, depend on the activities performed by the suppliers. For instance, the companies performing wet activities are the most engaged with the reduction of environmental issues. The objective of reducing the environmental impact is pursued through the innovation of processes and technologies in order to guarantee a more efficient use of resources. In this regard, a range of supporting industries have to be considered, as they provide the innovative solutions and contribute to the development of the denim industry.
Nevertheless, the environmental impact of a denim garment is the result of the contribution of each supplier in the value chain. Therefore, environmental sustainability is achieved through

the integration of the contributions and efforts of each actor and it is sufficient that even just one link in the chain is not sustainable to stain the entire value chain. Therefore, it is necessary an effective traceability, transparency, coordination and monitoring of the value chain.

In this context, the study reveals a satisfactory level of implementation of internal traceability of products and performance. However, the external traceability is more complicated and can be performed by only some of suppliers, in particular the largest ones or those that maintain close relationships with their sub-suppliers. This is due to the lack of traceability technologies; indeed, traceability is a technology driven concept, which depends on the adoption of proper technologies and maintenance of the system by each node of the supply chain (Kumar et al., 2017b). In order to ensure the traceability of the value chain, suppliers have to adopt smarter technologies and brands should establish a system that tracks all the products, parts and materials from suppliers, manufacturers and provides information on the components and their processing across the value chain, which ensures the garment's quality, safety and labeling. Furthermore, it is critical that whenever the actors of the value chain exchange the products, they have to provide also the product-related information along with the product. Moreover, in order to increase the transparency in the industry, brands can start to communicate the information resulting from the traceability process.

Despite the small-medium size of most of the denim suppliers and the lack of support by lead firms, it has emerged that suppliers have the necessary capabilities to enhance their processes and to spread the sustainability along the supply chain, by adopting collaboration with some of their upstream suppliers. Through partnerships, smaller companies might feel supported and could be able to perceive the change towards sustainable development as an opportunity to collaborate and benefit from it. Nevertheless, it would be desirable that brands engage in the spread of sustainability in all the phases of the denim value chain, since they have more power it is essential that they maintain control over the entire chain to avoid image damage. It is therefore desirable that brand establishes long-term relationships with strategically relevant suppliers that may include dedicated investments, sharing of information and best practices, and of particular importance, a climate of collaborative trust oriented towards achieving excellence in the final product to be offered to the consumer. Secondly, the monitoring and coordination action cannot stop at the first levels of supply, as their suppliers make use of additional sub-suppliers, and they have to be controlled in order to deliver a fully sustainable product. In conclusion, sustainability cannot be achieved in short period of time. It requires careful research and collaboration of all suppliers and stakeholders across the value chain.

5.4.2 Limitations and future research developments.

The contribution of this research work is a starting point for a study of sustainable supply chain management in the denim sector that has as its perspective the upstream suppliers of the denim value chain. Nevertheless, the current research presents several limitations, both for the quantitative and qualitative analysis, that should be considered when interpreting the results and that should be taken into account for future research developments.

With regard to the quantitative analysis, the sample includes a small number of observations, therefore by adding more observations the results could be different and more valid. The sustainability implementation score obtained by the surveyed companies may depend on the type of the activities included into the survey. For instance, if we change the activities, it could be that also the sustainability score changes. Furthermore, the range of each category of sustainability implementation was decided by the author based on some analysis.

A limitation of the qualitative analysis is that the research investigates only two or three companies belonging to each phase of the value chain, thus the low number of case studies. Therefore, the validity of these findings cannot be assumed as general findings for the whole denim sector or it cannot be generalizable to other fashion sectors. Furthermore, current research is focusing on the practices and actions of the upstream actors of the denim value chain and tries to identify the brands' position on sustainability through the evidence coming from the upstream suppliers. For a more complete and reliable perspective future research could increase the number of case studies and include in the analysis also the brands, in order to compare the perspective of brands with that of its suppliers. Therefore, future research could increase the number of case studies and include in the analysis also the brands, in order to compare the perspective of brands with that of its suppliers. Moreover, current research do not cover the fiber sector and the suppliers of accessories such as buttons, zippers, rivets applied on a denim garment. Therefore, future research could analyse also these actors of the denim value chain in order to provide a global overview of the suppliers part. The analysis focuses mainly on the area of North of Italy and in particular the Veneto area and the textile district. The territory and the contextual factors may in some way influence the results of the research. For instance, the location of companies in the so called district of denim, may result in some collaborations between suppliers and supporting industries to develop innovative and sustainable solutions, thus influencing the sustainability approach.

CONCLUSIONS

The aim of the this thesis was to achieve a complete overview of the current sustainability situation along the Italian denim value chain. By focusing on the upstream suppliers who stay behind the brands, the author tried to identify the environmental and social practices implemented so far, the drivers that pushed for sustainability and the criticalities that hinder its implementation, in order to establish the sustainability approach followed by the suppliers. Moreover, by analyzing the traceability of the value chain, the study aimed at identifying the premise for transparency in the industry and the possibility to achieve a sustainable value chain.

Based on the literature review, it was possible to identify the information necessary on which to base the analysis and to create the interviews and questionnaire. By interviewing nine Italian suppliers specialized on a specific phase in the denim value chain and by administering a questionnaire to 18 denim garment manufacturers, it was possible to gain a complete picture of the industry, and in particular to generate interesting findings. The cross case analysis made it possible to identify possible relationships between the internal and external drivers that push the commitment to sustainability and the approaches towards it. The analysed companies show a different approach towards sustainability, both in terms of propensity towards sustainability and practices adopted. The four approaches identified are the reactive, efficiency, proactive and value-seeker approach. In general, the reactive companies are small garment manufacturers who have less financial and human resources to dedicate to sustainability. The efficiency approach is followed by companies that have not submitted any external pressures from the market and are voluntarily implementing efficiency practices. The proactive and the value-seeker approaches are followed by the majority of the analysed firms who have been pushed by internal and external drivers, and are characterized by a good and outstanding level of implementation of internal and external sustainable practices. This implies that the level of awareness and commitment by Italian supplier companies on the environmental and social sustainability issues are already relevant to ensure the spread of sustainability further in the entire industry.

With regard to environmental practices, the most common are the adoption of innovative technologies, use of eco-friendly chemicals, certified and biodegradable raw materials, recycling textile waste, waste water treatment plants. The suppliers performing wet activities and employing chemicals are those that are most concerned about environmental practices. Most of the times, the reduction of environmental impacts translates into the reduction of production costs, thus achieving economic efficiency. Regarding the social practices, the

analysis has proven that operating in Italy, it is enough to follow the regulations and standards imposed by the government to achieve a satisfactory level of social sustainability. The issues related to social sustainability, in fact, are minimal among the companies interviewed. Most of the practices related to the social aspect are related to employee's contracts, welfare, safe working environments and safeguard of the local community.

Furthermore, the thesis investigated the traceability and transparency of the denim value chain. It derives that the majority of suppliers are able to trace their activities internally both related to product progress and sustainable performance. Quite all the companies are able to monitor the use of critical resources and the impacts deriving from their activities, though it is not a real-time traceability. However, not all the companies are able to trace their suppliers, due to the limited availability of traceability technologies and management systems. The external traceability is performed only by those companies that have a close relationship with their suppliers and that have a more integrated supply chain management systems. Although companies are able to trace all these useful information, transparency in the value chain is very limited, as brands are not communicating it.
In the context of sustainability and traceability, technology and innovative solutions provided by the supporting industries appear to have a significant role. Indeed, many suppliers have been able to improve their sustainability performance based on the innovations developed in the industry by chemical suppliers and supplier of technologies.

A strong point of this thesis derives from the fact that the interviewed companies and some of the surveyed workshops are linked together, with companies in the upper levels being suppliers of those at the lower tiers, thus the analysed value chain is in some way traceable. Manifattura di Cene is, in fact, the supplier of Berto; Berto and Candiani Denim are suppliers of Project. Some of the garment manufacturers and all the laundry and dyeing companies are also suppliers of Project, thus they manufacture and finish the garments made from Berto's and Candiani's denim. Moreover, Zaitex and Tonello are suppliers of Everest. Therefore, in this case Project acts as the coordinator of the investigated value chain.

From an academic point of view, the results of this thesis represent a first contribution to the analysis of sustainability of the Italian denim value chain, from the point of view of the upstream suppliers. There is no other studies in the literature that have investigated before, the Italian denim value chain by focusing on suppliers. Therefore, it offers valid ideas for possible future research and developments.

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APPENDIX

Appendix 1 – The list of Italian fashion districts

Table 5: The list of the Italian districts operating in the fashion industry[14]

District's Name	Province	Specialization
Apparel and Footwear district of Brescia	Brescia	Apparel, Footwear, Knitwear
Textile – Apparel district of Gallaratese	Varese	Apparel, Knitwear, Cotton Fabrics
Hosiery district of Castel Goffredo	Mantua	Hosiery
Silk district of Como	Como	Apparel, Silk Fabrics
Textile district of Biella	Biella	Apparel, Wool Yarns and Fabrics
Textile – Apparel district of Val Seriana	Bergamo	Apparel, Cotton Yarns and Fabrics
Apparel district of Rimini	Rimini	Apparel, Knitwear
Knitwear and Apparel district of Carpi	Modena	Apparel, Knitwear
Textile – Apparel district of Schio-Thiene-Valdagno	Vicenza	Apparel, Wool Yarns and Fabrics, Knitwear
Apparel district of Bari	Bari	Apparel, Underwear
Apparel District of Naples	Naples	Apparel
Textile - apparel district of Treviso	Treviso	Apparel, Knitwear, Cotton Fabrics
Apparel district of Empoli	Florence	Apparel, Knitwear
Apparel district of Ancona	Ancona	Apparel, Knitwear
Apparel district of Ascoli	Ascoli Piceno	Apparel
Apparel district of Macerata	Macerata	Apparel
Jeans Valley of Montefeltro	Pesaro and Urbino	Jeans
Knitwear and apparel district of Perugia	Perugia	Apparel, Knitwear
Textile - apparel district of Arezzo	Arezzo	Apparel, Knitwear, Fabrics
Textile - apparel district of Prato	Prato	Apparel, Wool Yarns and Fabrics, Knitwear
Apparel district of North of Abruzzo	Teramo	Apparel, Knitwear
Apparel district of South of Abruzzo	Chieti and Pescara	Apparel
Hosiery and apparel district of Salento	Lecce	Apparel, Knitwear
Footwear district of Vigevano	Pavia	Footwear
Footwear district of Montebelluna	Treviso	Sports Footwear
Footwear district of Verona	Verona	Footwear
Footwear district of Brenta	Padua & Venice	Footwear
Footwear district of Fermo	Ascoli Piceno & Macerata	Footwear
Footwear district of Lamporecchio	Pistoia	Footwear
Footwear district of Lucca	Lucca	Footwear
Leather and Footwear district of Arezzo	Arezzo	Footwear
Leather and Footwear district of Florence	Florence	Footwear and leatherwear
Footwear district of Casarano	Lecce	Footwear
Footwear district of Naples	Naples & Caserta	Footwear

source: author's elaboration based on (Intesa Sanpaolo - Direzione Studi e Ricerche , 2018)

[14] Including apparel, footwear and leatherwear

Appendix 2 – Questionnaire administrated to garment manufacturers

Questionario Progetto Filiera Fantasma

Il presente questionario viene svolto a cura del ***Progetto Filiera Fantasma*** *intitolato "****The Ghost Makers: L'universo sconosciuto dei laboratori veneti****". Il Progetto Filiera Fantasma intende riunire il valore delle competenze dei laboratori veneti in un'unica piattaforma, così da presentarlo in modo corretto e efficace ai brand mondiali del luxury fashion. Lo scopo del questionario è di rendere visibile il saper fare, la creatività, le capacità e il rispetto dei principi etici della responsabilità sociale dei laboratori veneti, in modo tale da poter aumentare il numero e la qualità delle collaborazioni con i brand.*

INFORMAZIONI GENERALI, MERCATI E CLIENTI

1. Denominazione sociale:

_____

2. Comune e provincia sede principale:

_____

3. Anno di costituzione:

_____

4. Quali sono i prodotti confezionati dall'impresa?
(possibili più risposte)

a. Pantalone
b. Giacca
c. Camicia
d. Gonna
e. Vestito
f. Total look
g. Altro (specificare)

5. Fatturato globale dell'impresa (anno 2018):

a. Fino a 100 Mila Euro
b. 100 - 200 Mila Euro
c. 201- 500 Mila Euro
d. 501– 999 Mila Euro
e. > 1 Milione di Euro

6. Quanto pesa il primo cliente sul fatturato (**in %**), e indicare il nome del **cliente** e i relativi **brand**?

---

7. Come vengono gestiti i rapporti con i clienti?
(possibili più risposte)

a. Rapporto diretto con il cliente/brand.
b. Rapporto di sub-fornitura.

8. Se l'impresa gestisce un rapporto diretto con il cliente/brand, indicare il nome dei **clienti** e i relativi **brand.**

Cliente	Brand

9. Se l'impresa svolge l'attività di sub-fornitura, indicare il nome dei **committenti** e i relativi **brand** per cui lavorano.

Committente	Brand

10. L'impresa offre i suoi prodotti/servizi a clienti/brand sotto audit? **Se sì, indicare il nome dei clienti e i relativi brand.**

a. Sì
b. No

Cliente	Brand

11. A livello di localizzazione geografica, quanta percentuale del fatturato dell'impresa viene realizzato da clienti localizzati in?
(indicare una risposta per ogni riga)

	< 1%	1 - 5 %	6 -10 %	11 - 20 %	21 - 30 %	31 - 40 %	41 - 50 %	51 - 70 %	> 70 %
Veneto	◯	◯	◯	◯	◯	◯	◯	◯	◯
Altre regioni d'Italia	◯	◯	◯	◯	◯	◯	◯	◯	◯
Paesi dell'UE	◯	◯	◯	◯	◯	◯	◯	◯	◯
Altri paesi Europei	◯	◯	◯	◯	◯	◯	◯	◯	◯
Resto del mondo	◯	◯	◯	◯	◯	◯	◯	◯	◯

12. Quante persone (soci + dipendenti) lavorano nell'impresa (2018)?

_____

13. Quale è l'età media dei lavoratori ?

_____

14. Che attività viene svolta all'interno della sua azienda?

_____

_____

_____

15. All'interno del processo produttivo come vengono organizzate le mansioni dei lavoratori?
(possibili più risposte)

a. I dipendenti ruotano tra diverse mansioni (job rotation)
b. I dipendenti svolgono solo una determinata attività/mansione
c. I dipendenti svolgono più di una attività/mansione

16. Indicare i fattori di vantaggio competitivo per l'impresa:
(in una scala da 1- per niente a 5-moltissimo)

	1	2	3	4	5	Non di competenza dell'impresa
Qualità dei prodotti	◯	◯	◯	◯	◯	◯
Innovazione di prodotto	◯	◯	◯	◯	◯	◯
Flessibilità produttiva	◯	◯	◯	◯	◯	◯
Riduzione costi di produzione	◯	◯	◯	◯	◯	◯
Servizio al cliente	◯	◯	◯	◯	◯	◯
Responsabilità sociale	◯	◯	◯	◯	◯	◯
Capacità e competenze distintive	◯	◯	◯	◯	◯	◯
Formazione dei dipendenti	◯	◯	◯	◯	◯	◯

17. L'impresa ha accesso a servizi a banda larga?
(possibili più risposte)

a. ADSL (Linea Asimmetrica di Sottoscrizione Digitale)
b. Fibra ottica
c. Connessione wireless
d. Connessione mobile
e. Nessuna

18. Quale dei seguenti dispositivi elettronici vengono utilizzati dall'impresa?
(possibili più risposte)

a. Personal Computer
b. Tablet
c. Smartphone
d. Nessuno

19. Quali delle seguenti tecnologie utilizza l'impresa?
(possibili più risposte)

a. Sito web
b. Facebook
c. Instagram
d. Linkedin
e. Twitter
f. Youtube

g. E-commerce (es. sito web aziendale)
h. Email
i. Software per la produttività individuale (es. Microsoft Office)
j. Software per la gestione dell'amministrazione
k. Software per l'integrazione gestionale con il cliente
l. Cloud computing (es. Google Drive, Dropbox)
m. Nessuna

20. Quali delle seguente tecnologie utilizzano le persone ai vertici dell'azienda?
(se ci sono più persone ai vertici aziendali indicare per ognuna il Nome Cognome e le tecnologie utilizzate)

Persona 1:
Nome _____ **Cognome**

(possibili più risposte)
a. Sito web
b. Facebook
c. Instagram
d. Linkedin
e. Twitter
f. Youtube
g. Email
h. Cloud computing (es. Google Drive, Dropbox)
i. Nessuna

Persona 2:
Nome _____ **Cognome**

(possibili più risposte)
a. Sito web
b. Facebook
c. Instagram
d. Linkedin
e. Twitter
f. Youtube
g. Email
h. Cloud computing (es. Google Drive, Dropbox)
i. Nessuna

Persona 3:
Nome _____ **Cognome**

(possibili più risposte)
a. Sito web
b. Facebook
c. Instagram
d. Linkedin
e. Twitter

f. Youtube
g. Email
h. Cloud computing (es. Google Drive, Dropbox)
i. Nessuna

21. L'impresa utilizza strumenti tecnologici per misurare e controllare gli stati di avanzamento dei prodotti? **Se sì, indicare quali?**

a. Sì _____

b. No

BRAND AUDIT E RESPONSABILITÀ SOCIALE E AMBIENTALE

22. L'impresa svolge la sua attività tenendo conto della responsabilità sociale e ambientale?

a. Sì
b. No

23. Le attività dell'impresa comprendono in qualche modo le seguenti opzioni?
(*in una scala da 1- per niente a 5-moltissimo)*

	1	**2**	**3**	**4**	**5**	**Non di competenza dell'impresa**
Attività formative volte allo sviluppo dei dipendenti oltre a quelle previste dall'obbligatorietà legislativa	◯	◯	◯	◯	◯	◯
Attività e/o procedure volte ad accrescere il livello di igiene, salute e sicurezza del luogo di lavoro	◯	◯	◯	◯	◯	◯
Corsi di formazione e attestati di frequenza in ambito salute e sicurezza dei dipendenti	◯	◯	◯	◯	◯	◯
Politiche che assicurano agevolazioni o servizi aziendali ai dipendenti	◯	◯	◯	◯	◯	◯
Piano d'azione per le pari opportunità	◯	◯	◯	◯	◯	◯
Redazione del Documento di	◯	◯	◯	◯	◯	◯

Valutazione dei Rischi (DVR)	
Possesso del Certificato di prevenzione incendi e/o SCIA (Segnalazione Certificata di Inizio Attività)	◯ ◯ ◯ ◯ ◯ ◯
Possesso della Certificazione di avvenuta manutenzione dei sistemi antincendio (estintori, rilevatori di fumo ecc.)	◯ ◯ ◯ ◯ ◯ ◯
Possesso di Certificazione di conformità dell'impianto elettrico	◯ ◯ ◯ ◯ ◯ ◯
Implementazione di un Codice Etico	◯ ◯ ◯ ◯ ◯ ◯
Riduzione dell'utilizzo di risorse (acqua, energia, materie prime)	◯ ◯ ◯ ◯ ◯ ◯
Prevenzione della produzione di rifiuti e riduzione degli sprechi	◯ ◯ ◯ ◯ ◯ ◯
Iscrizione al SISTRI (Sistema di controllo della tracciabilità dei rifiuti)	◯ ◯ ◯ ◯ ◯ ◯
Formazione e addestramento dei dipendenti per il rispetto dell'ambiente	◯ ◯ ◯ ◯ ◯ ◯

24. L'impresa svolge la sua attività tenendo conto della responsabilità sociale e ambientale?

c. Sì
d. No

25. Indicare quanto l'audit ha influenzato l'attività operativa dell'impresa?
(*in una scala da 1- per niente a 5 - moltissimo)*

Nota Bene: Rispondere alle domande di questa sezione solo in caso di risposta affermativa nella domanda 10

	1	**2**	**3**	**4**	**5**	**Non di competenza dell'impresa**
Risparmio sui costi grazie al miglioramento dell'efficienza dei processi produttivi, alla formazione del	◯	◯	◯	◯	◯	◯

personale, alla tutela delle risorse etc.	
Aumento dei rapporti di collaborazioni con i clienti (brand) di lusso	○ ○ ○ ○ ○ ○
Migliore identificazione dei dipendenti, grazie ad una maggiore responsabilità della forza lavoro, a una completa protezione sul lavoro e ad una efficace gestione della salute	○ ○ ○ ○ ○ ○
Migliore posizione sul mercato grazie al miglioramento dell'immagine e reputazione	○ ○ ○ ○ ○ ○
Aumento (percentuale) del fatturato (rispetto a prima dell'audit)	○ ○ ○ ○ ○ ○
Aumentata la varietà dei prodotti/servizi offerti	○ ○ ○ ○ ○ ○
Migliorata la motivazione dei dipendenti	○ ○ ○ ○ ○ ○
Riduzione dei tempi di confezionamento dei prodotti grazie alla formazione dei dipendenti e al miglioramento delle condizione lavorative	○ ○ ○ ○ ○ ○
Maggiore attenzione alle condizione lavorative dei dipendenti	○ ○ ○ ○ ○ ○

26. Se ne indichino le principali motivazioni che hanno spinto a comportarsi in modo più sostenibile e responsabile?
(possibili più risposte)

a. Rispondere alle richieste dei clienti o committenti
b. Rispondere alla richiesta dai sindacati attenti alle tematiche di sostenibilità
c. Allinearsi con la concorrenza
d. Allinearsi con le richieste della normativa esistente o futura
e. Motivi etici e coerenza con la visione e i principi dell'impresa

f. Agevolazioni fiscali e contributi
g. Aumentare il valore dei prodotti/servizi offerti
h. Migliorare la posizione competitiva dell'impresa nei mercati esistenti
i. Ridurre i costi di produzione
j. Gestire il rischio reputazionale
k. Altro (specificare)

27. Quali sono nella vostra esperienza le principali difficoltà all'implementazione di una politica aziendale di responsabilità sociale?
(possibili più risposte)

a. Scarsità di risorse economiche e di tempo
b. Difficoltà nel reperire le informazioni necessarie a causa della complessa articolazione della catena di fornitura
c. Mancanza di competenze interne all'azienda sui temi di responsabilità sociale
d. Sistemi informativi interni inadeguati
e. Altro (specificare)

28. L'impresa sta svolgendo altre attività sostenibili sia dal punto di vista sociale che ambientale oltre a quelle elencate in questo questionario? Se sì, indicare quali attività.

_____

_____

_____

Appendix 3 - The interview to yarn and denim producers: questions

1) Può descrivere brevemente l'attività che l'azienda ricopre all'interno della filiera, i suoi prodotti e il mercato di riferimento? Quanti dipendenti ha l'azienda?

2) Come vengono gestiti i rapporti con il cliente/brand: rapporto diretto con il cliente o rapporto di sub-fornitura? Potrebbe gentilmente indicare alcuni nomi più importanti dei suoi clienti o committenti e i relativi brand per cui lavorano? L'azienda dispone di brand di propri?

3) L'impresa offre i suoi prodotti a clienti o brand sotto l'audit sociale? Se sì, su cosa si focalizza l'audit, e quanto ha influenzato l'attività operativa dell'impresa?

4) Quali tecnologie (ICT) sono state adottate dalla sua azienda e a che scopo?

5) Potrebbe gentilmente indicare se e quali tecnologie dell'industria 4.0 vengono utilizzate in azienda? Se l'azienda non dispone di tecnologie 4.0, si descriva il livello di automazione delle tecnologie o dei macchinari utilizzati nei processi produttivi, e quanto questi hanno migliorato l'efficienza, il controllo e la tracciabilità dei processi e prodotti?

6) Quali strumenti IT sono utilizzati per tracciare, monitorare e gestire le performance di sostenibilità ambientale? L'azienda dispone di strumenti e tecnologie per poter misurare il ciclo di vita del prodotto (Life Cycle Assessment)?

7) Quale importanza viene attribuita al termine sostenibilità ambientale e sociale all'interno della vostra azienda? L'azienda dispone di una strategia di gestione della sostenibilità ambientale e sociale che guida il processo decisionale a lungo termine? Se sì, quali sono i temi principali sui quali si focalizza la strategia?

8) Cosa sta spingendo l'azienda a diventare più sostenibile: pressioni esterne all'azienda (ex: clienti, brand, mercati o pressione legislativa, fenomeni socio-culturali) o pressioni interne (ex: volontà del management)? Ci sono pressioni da parte dei vostri clienti o da parte dei brand? Quali requisiti (ambientali e sociali) vengono richiesti e quanto sono rilevanti?

9) Quali sono gli attori che più promuovono la sostenibilità all'interno della filiera? Quanto il fatto di diventare sostenibile sia spinto dai fornitori di tecnologie e materie prime?

10) Potrebbe cortesemente indicare quali tecnologie e processi innovativi di lavorazione vengono utilizzati all'interno della vostra azienda e qual è il loro impatto ambientale?

11) Quale è l'impatto ambientale degli input produttivi che utilizza per la filatura, tintoria e finissaggio, tessitura e nobilitazione e altri trattamenti dei filati e tessuti? Come viene misurato l'impatto e come viene garantita la tracciabilità degli input utilizzati? Quali criteri vengono utilizzati per selezionare fornitori di materie prime dal punto di vista della sostenibilità ambientale?

12) Quali linee guida o procedure formali vengono date dai brand owner per diffondere la sostenibilità lungo le diverse fasi della SC? Sapete se i Brand Owner hanno utilizzato criteri dal punto di vista della sostenibilità ambientale per selezionarvi? Se si, conoscete esplicitamente i criteri utilizzati? Vengono fornite da parte dei Brand Owner delle direttive sui materiali da utilizzare o liste di materiali da evitare?

13) L'azienda è in possesso di certificazioni/norme di sostenibilità che garantiscano la sicurezza dei prodotti e dell'ambiente lavorativo? (Sì – No) Se sì, specificare quali e indicarne alcuni vantaggi. È stato una cosa volontaria o è stato richiesta dai clienti?

14) Potrebbe gentilmente indicare che tipo di fibre vengono utilizzati per realizzare i vostri prodotti? Le fibre di cotone che state utilizzando sono in cotone convenzionale o organico? Ci sono filati innovativi e sostenibili che l'azienda sta producendo?

15) Quanto i vostri prodotti sono pensati per un eventuale riutilizzo o riciclo alla fine della loro vita utile?

16) L'impresa sta effettuando l'attività di monitoraggio e la tracciabilità dei rifiuti, consumi di acqua, energia e emissioni CO_2? Se sì, in che modo? Quali sono i processi o le operazioni che consumano la maggiore quantità di energia, acqua e producono maggiori rifiuti e emissioni CO2? (*fornire un po' di numeri)*

17) Quali sono le attività che l'impresa svolge o le tecnologie che l'azienda sta adottando per risparmiare l'utilizzo di risorse (acqua, energia, materie prime) e la creazione dei rifiuti ed emissioni CO2, e quali sono i risultati ottenuti (*fornire un po' di numeri*)? L'azienda ha stabilito un benchmark per l'uso di energia, acqua, emissioni CO2 e rifiuti per poter confrontare il miglioramento nel tempo?

18) Come vengono trattati i sotto-prodotti, rifiuti o i residui di lavorazione (acqua, residui tessili e chimici)? L'impresa dispone di tecnologie per il trattamento o riutilizzo delle acque reflue dei processi produttivi?

19) In che modo viene garantita la sicurezza, il benessere e la salute dei lavoratori nell'ambiente lavorativo e la prevenzione degli infortuni? L'azienda offre formazione e istruzione al personale in materia di sicurezza sul lavoro e sul tema della sostenibilità?

20) Quanto del processo che voi controllate entra nella comunicazione del brand/ cliente?

21) Quali sono le altre attività con riguardo alla tracciabilità e sostenibilità ambientale e sociale che state mettendo in atto e che non sono emerse dalle domande qui sopra? E quali sono i benefici e le sfide per mantenere i processi e i prodotti sostenibili?

Appendix 4 - The interview to laundry companies: questions

1) Può descrivere brevemente l'attività che l'azienda ricopre all'interno della filiera, i suoi prodotti e il mercato di riferimento? Quanti dipendenti ha l'azienda?

2) Come vengono gestiti i rapporti con il cliente/brand: rapporto diretto con il cliente o rapporto di sub-fornitura?

3) L'impresa offre i suoi prodotti a clienti o brand sotto l'audit sociale? Se sì, su cosa si focalizza l'audit, e quanto ha influenzato l'attività operativa dell'impresa? I vostri clienti vi hanno applicato un codice di condotta con dei standard che dovete seguire?

4) Potrebbe gentilmente indicare se e quali tecnologie dell'industria 4.0 vengono utilizzate in azienda? Se l'azienda non dispone di tecnologie 4.0, si descriva il livello di automazione delle tecnologie o dei macchinari utilizzati nei processi produttivi, e quanto questi hanno migliorato l'efficienza, il controllo e la tracciabilità dei processi e prodotti?

5) L'impresa dispone di un sistema di tracciabilità e misurazione che permette di controllare gli stati di avanzamento dei prodotti/processi o la tracciabilità di questi?

6) Quale importanza viene attribuita al termine sostenibilità ambientale e sociale all'interno della vostra azienda? L'azienda dispone di una strategia di gestione della sostenibilità ambientale e sociale che guida il processo decisionale a lungo termine sulla gestione della sostenibilità? Se sì, quali sono i temi principali sui quali si focalizza la strategia?

7) Cosa sta spingendo l'azienda a diventare più sostenibile: pressioni esterne all'azienda (ex: clienti, brand, mercati o pressione legislativa, fenomeni socio-culturali) o pressioni interne (ex: volontà del management)? Ci sono requisiti (ambientali e sociali) che vengono richiesti dai vostri clienti/brand?

8) Quali sono gli attori che più promuovono la sostenibilità all'interno della filiera? Quanto è importante il ruolo dei vostri fornitori di sostanze chimiche e di macchinari per diventare più sostenibili?

9) Sapete se i Brand hanno utilizzato criteri dal punto di vista della sostenibilità ambientale per selezionarvi? Se si, conoscete esplicitamente i criteri utilizzati? Vengono fornite da parte dei Brand delle direttive sui materiali da utilizzare o liste di materiali da evitare?

10) Potrebbe cortesemente indicare quali tecnologie e processi innovativi di lavorazione utilizza per i trattamenti, lavaggi, finissaggi e lavorazioni del denim, e quanto eco-sostenibili sono e quale è il loro impatto ambientale? L'azienda ha identificato gli impatti ambientali più significativi associati alle operazioni correnti all'interno della fabbrica?

11) Quale è l'impatto ambientale degli input produttivi che utilizza per il trattamento, tintura, lavaggio del denim? Come viene misurato l'impatto e come viene garantita la tracciabilità degli input utilizzati (agenti chimici, coloranti)?

12) L'azienda è in possesso di certificazioni / norme di sostenibilità che garantiscano la sicurezza dei prodotti utilizzati e dell'ambiente lavorativo? (Sì – No) Se sì, specificare quali e indicare i vantaggi.

13) In che modo viene garantita la sicurezza, il benessere e la salute dei lavoratori nell'ambiente lavorativo e la prevenzione degli infortuni?

14) L'impresa sta effettuando l'attività di monitoraggio e la tracciabilità dei rifiuti, consumi di acqua, energia e emissioni CO_2? Se sì, in che modo?

15) Quali sono le attività che l'impresa svolge o le tecnologie che l'azienda sta adottando per risparmiare l'utilizzo di risorse (acqua, energia, materie prime) e la creazione dei rifiuti ed emissioni CO2, e quali sono i risultati ottenuti (*fornire un po' di numeri*)?

16) Come vengono trattati i sotto-prodotti, rifiuti o i residui di lavorazione (acqua, residui chimici)? L'impresa dispone di tecnologie per il trattamento o riutilizzo delle acque reflue dei processi produttivi?

17) Sono previsti degli indicatori in grado di monitorare la sostenibilità, ambientale e sociale? Se si, quali? Come è cambiata la performance di sostenibilità dell'azienda nel tempo rispetto a questi indicatori?

18) Quanto del processo che voi controllate entra nella comunicazione del brand/ cliente?

19) Quali sono le altre attività con riguardo alla tracciabilità e sostenibilità ambientale e sociale che state mettendo in atto e che non sono emerse dalle domande qui sopra? E quali sono i benefici e le sfide per mantenere i processi e i prodotti sostenibili?

Appendix 5 - The interview to the supplier of garment finishing technologies: questions

1) Può descrivere brevemente l'attività dell'impresa, i suoi prodotti/servizi e il mercato di riferimento?

2) Quali sono le nuove tecnologie emergenti nel settore del finissaggio tessile, in particolare nel denim? E come queste tecnologie riescono a risolvere gli aspetti più critici della sostenibilità nel mondo denim?

3) Potrebbe raccontare in cosa consiste le tecnologie NoStone e Wake sviluppate dalla vostra azienda? Quali sono i benefici ottenuti in termini di sostenibilità ambientale?

4) Quanto sostenibili sia dal punto di vista ambientale che sociale sono i macchinari prodotti dalla vostra azienda? In che modo le vostre macchine permettono ai vostri clienti di essere sostenibili ed efficienti?

5) La vostra azienda sta producendo macchinari per il finissaggio del capo denim rientranti nell'Industria 4.0? Se sì, in che modo queste tecnologie possono migliorare l'efficienza e il controllo dei processi, la tracciabilità degli input e dell'intero processo produttivo?

6) Le macchine sviluppate dalla vostra azienda permettono la tracciabilità e la trasparenza dei dati necessari per determinare il livello di sostenibilità di un processo o prodotto che sta eseguendo?

7) Quali sono le tecnologie per il finissaggio del capo denim più utilizzate o richieste dai vostri clienti?

8) Come avviene l'innovazione di prodotto all'interno dell'azienda: in base alle esigenze e trend del mercato, specifiche del cliente (demand pull), o in base alla volontà dell'azienda di sfruttare le tecnologie disponibili proponendo nuove alternative al cliente (technology push)? Il fatto di avere i vostri clienti vicino, vi aiuta in qualche modo a sviluppare nuovi prodotti?

9) Quanto i macchinari per fare i diversi effetti o lavaggi sul denim hanno influenzato la scelta delle materie prime come tessuti o colorazione? Il tipo di finissaggio o lavorazione da eseguire sul capo denim influenza in qualche modo l'innovazione di prodotto?

10) Avevo letto che la sua azienda ha vinto una Green Label, potrebbe raccontare cosa prevede questa label?

11) Secondo Lei in che modo il settore del denim potrebbe diventare più sostenibile nei prossimi anni?

Appendix 6 - The interview to the chemical supplier: questions

1) Può descrivere brevemente l'attività dell'impresa, i suoi prodotti e il mercato di riferimento?

2) Descrivere quali attività ricopre l'azienda all'interno della filiera e il numero di dipendenti?

3) Chi sono i vostri clienti? Potrebbe gentilmente indicare alcuni nomi più importanti dei suoi clienti e i relativi brand per cui lavorano?

4) L'impresa offre i suoi prodotti/servizi a clienti sotto l'audit sociale? Se sì, cosa prevedeva l'audit, e quanto ha influenzato l'attività operativa dell'impresa? I vostri clienti vi hanno applicato un codice di condotta con dei standard che dovete seguire?

5) Potrebbe gentilmente indicare se e quali tecnologie dell'industria 4.0 vengono utilizzate in azienda? Se l'impresa non dispone di tecnologie 4.0, si descriva il livello di automazione delle tecnologie utilizzati nei processi produttivi, e quanto questi hanno migliorato l'efficienza, il controllo e la tracciabilità dei processi?

6) Quale importanza viene attribuita alla sostenibilità ambientale e sociale all'interno della vostra azienda? L'azienda dispone di una strategia di gestione della sostenibilità ambientale e sociale che guida il processo decisionale?

7) Cosa sta spingendo l'azienda a diventare più sostenibile e responsabile: pressioni esterne all'azienda (ex: clienti, brand, mercati, pressione legislativa, fenomeni socio-culturali) o pressioni interne (ex: volontà del management)? Quali requisiti (ambientali e sociali) vengono richiesti dai vostri clienti o brand e quanto sono rilevanti?

8) Quanto sostenibili sia dal punto di vista ambientale che sociale sono i vostri prodotti? Quanto gli aspetti di sostenibilità hanno influenzato l'attività dell'azienda e il sviluppo di nuovi prodotti? Ci sono stati dei casi in cui l'azienda ha dovuto non produrre più determinati prodotti per alcuni clienti?

9) Quali sono le nuove sostanze chimiche, coloranti e agenti utilizzate nel settore delle tinture, lavaggi, trattamenti vari e finissaggio tessile, in particolare nel denim? E come questi riescono a risolvere gli aspetti più critici della sostenibilità nel mondo denim?

10) Quanto i vostri prodotti per fare i diversi lavaggi, trattamenti e finissaggi hanno influenzato l'innovazione degli effetti ottenuti sul denim o la scelta del tessuto denim? Il tipo di finissaggio da eseguire influenza in qualche modo l'innovazione del vostro prodotto?

11) Come avviene l'innovazione di prodotto all'interno dell'azienda: in base alle esigenze e specifiche del cliente o siete voi che la stabilite, proponendo nuovi prodotti? Il fatto di avere i vostri clienti vicino, vi aiuta in qualche modo a sviluppare nuovi prodotti?

12) Sapete se i vostri clienti hanno utilizzato criteri dal punto di vista della sostenibilità ambientale per selezionarvi? Se si, conoscete esplicitamente i criteri utilizzati? Vengono fornite da parte dei vostri clienti delle direttive sui materiali da utilizzare o liste di materiali da evitare?

13) Come vengono trattati i sotto-prodotti, rifiuti o i residui di lavorazione (acqua, residui chimici)?

Appendix 7 - The interview to Project: questions

1) Può descrivere brevemente quali attività ricopre l'azienda all'interno della filiera, i suoi prodotti/servizi e il mercato di riferimento? Il numero di dipendenti?

2) Come viene gestito il rapporto con il cliente/brand? Potrebbe gentilmente indicare alcuni nomi più importanti dei suoi clienti e i relativi brand per cui lavorano?

3) L'impresa offre i suoi prodotti/servizi a clienti sotto l'audit sociale? Se sì, cosa prevedeva l'audit, e quanto ha influenzato l'attività operativa dell'impresa?

4) Quali tecnologie (ICT) sono state adottate dalla sua azienda e a che scopo?

5) L'impresa dispone di un sistema di tracciabilità e misurazione che permette di controllare gli stati di avanzamento dei prodotti commissionati o la tracciabilità di questi?

6) Quale importanza viene attribuita al termine sostenibilità ambientale e sociale all'interno della vostra azienda? L'azienda dispone di una strategia di gestione della sostenibilità ambientale e sociale che guida il processo decisionale a lungo termine? Se sì, quali sono i temi principali sui quali si focalizza la strategia?

7) Cosa sta spingendo l'azienda a diventare più sostenibile e responsabile: pressioni esterne all'azienda (ex: clienti, brand, mercati, pressione legislativa, fenomeni socio-culturali) o pressioni interne (ex: volontà del management)? Ci sono pressioni da parte dei brand? Quali requisiti (ambientali e sociali) con riguardo ai prodotti vengono richiesti dai vostri clienti/brand e quanto sono rilevanti?

8) State in qualche modo a monitorando le performance di sostenibilità dei vostri fornitori? Se si, in che modo? Sono previsti degli indicatori in grado di monitorare la sostenibilità, ambientale e sociale? Se si, quali? Quanto del processo che voi controllate entra nella comunicazione del brand?

9) Quali criteri vengono utilizzati per selezionare fornitori di materie prime? E quali criteri vengono utilizzati dal punto di vista della sostenibilità ambientale e sociale? I Brand chiedono di avere fornitori certificati?

10) Sapete se i vostri clienti/brand hanno utilizzato criteri dal punto di vista della sostenibilità per selezionarvi? Se si, conoscete esplicitamente i criteri utilizzati?

11) Quali linee guida o procedure formali vengono date dai brand per diffondere la sostenibilità lungo le diverse fasi della filiera del denim? Vengono fornite da parte dei vostri clienti/brand delle direttive sui materiali da utilizzare o liste di materiali da evitare? Vengono applicati codici di condotta da pare dei brand presso i vostri fornitori?

12) Quali sono gli attori che più promuovono la sostenibilità all'interno della filiera? I brand chiedono le informazioni riguardanti i processi dei vostri fornitori.

13) Secondo Lei in che modo il settore del denim potrebbe diventare più sostenibile nei prossimi anni?

14) Come è nata l'idea di Filiera fantasma? E quali sono gli obiettivi che si vogliono raggiungere?

15) Quanto è importante la trasparenza e la tracciabilità della filiera nel contesto attuale del sistema moda Italiano?