



# Textile Historical Sustainability and Innovative Textile Products

Eleonora Trivellin<sup>1</sup>(✉), Giuseppe Lotti<sup>2</sup>, Marco Marseglia<sup>2</sup>,  
Elisa Matteucci<sup>2</sup>, Margherita Vacca<sup>2</sup>, Irene Fiesoli<sup>2</sup>, Claudia Morea<sup>1</sup>,  
Alessio Tanzini<sup>1</sup>, Francesco Tanzini<sup>2</sup>, and Lu Ji<sup>1</sup>

<sup>1</sup> Dipartimento di Architettura, Università di Ferrara, Ferrara, Italy  
eleonora.trivellin@unife.it

<sup>2</sup> Dipartimento di Architettura, Università di Firenze, Firenze, Italy

**Abstract.** Textile surfaces have expressed a great deal of changes related to the meanings they are able to transmit as a communication layer and also as a technological product.

We can read this path in an exemplary way with the analysis of the largest textile district in Europe, the one that belongs to the city of Prato in Tuscany. The typical product of this area - regenerated carded - has seen its nature transform from a low quality and value product to a technological and environmental excellence.

**Keywords:** Textile · Innovation · Prato · Carded wool · Industry 4.0

## 1 Introduction

The strategic importance of textile products manifests itself in the various production sectors and not only in the clothing sector.

With the value of “communication layer” they were able to take on not only technological but also communicative and symbolic meanings in the strictest sense [1].

The strength of these products lies in being able to express strongly consolidated meanings together with others of great innovation.

Somehow, during their evolution, what we can see defined by the first industrial revolution forward has been confirmed, that is to say, it is a field of great experimentation for the application of new forms of energy, new design methods, new applications of mechanics and the standardization of products and, at the same time, remain closely linked to local resources and, more generally, to territorial skills [2].

---

The text was thought of authors all together. In particular Eleonora Trivellin wrote paragraphe no. 4 Carded: manufacturing cycle and no 5 The Manteco company; Giuseppe Lotti wrote paragraphe no. 1 Introduction; Elisa Matteucci wrote paragraphe no. 3 The production structure; Marco Marseglia wrote the first paragraph of paragraphe no. 2 Territory and society; Claudia Morea wrote the second paragraph of paragraphe no. 2 Territory and society; Francesco Cantini wrote the third paragraph of paragraphe no. 2 Territory and society; Alessio Tanzini wrote the fourth and fifth paragraphs of paragraphe no. 2 Territory and society; Margherita Vacca edited the bibliography and the notes; Lu Ji found and edited the images.

© The Editor(s) (if applicable) and The Author(s), under exclusive license to Springer Nature Switzerland AG 2020

G. Di Bucchianico et al. (Eds.): AHFE 2020, AISC 1202, pp. 862–869, 2020.

[https://doi.org/10.1007/978-3-030-51194-4\\_111](https://doi.org/10.1007/978-3-030-51194-4_111)

The fact that man, from the dawn of civilization until today, has used most of his energies to nourish himself and to cover his body, giving these activities also strongly symbolic values, reminds us of the reason, precisely on the actions of intertwining a lot of attention has always been focused both from an operational and theoretical point of view. Furthermore, the link between nourishment, and therefore breeding and agriculture and weaving has always been very strong and strategic for the development of archaic societies. With the great attention paid today to sustainability, the relationship with the food supply chain, and agriculture in general, has returned to being very topical.

Contextualizing our study on the Prato district, the elements to be taken into consideration are the conformation of the territory and urban development; the economy; the organization and transformation of the company, the process and the resulting product. We will necessarily focus on the last two factors but, it would not be possible to understand the originality and peculiarity of carded and regenerated wool without at least mentioning the other factors as they are all closely connected.

In order to exemplify, we will go on to state the example of an emblematic company in the Prato area.

## 2 Territory and Society

The urbanized countryside [3], which characterizes the Prato area around the urban center, is made up of a fabric that holds industrial and civil buildings together; In Prato there are still the houses with the adjoining *stanzone* in which small artisan companies, often of a family nature, operate on behalf of third parties for the woolen clients.

Great production fragmentation but, at the same time, coordination for waste management: since the 1980s, a cutting-edge centralized system for the purification of civil and industrial waste water has been created thanks to public-private investments. In Prato's society, work is at the center of life and entrepreneurship is considered an attitude based more on knowing how to do than on knowing so much that Prato, at least until 2008 the year of the great crisis, precisely because of the high percentage of employees, had a very low rate of graduates compared to the rest of Tuscany. The rarefied urban fabric of Prato which develops in many small smaller towns, as well as favored the development of a predominantly horizontal economy, has been conducive to the establishment of Chinese workers who have been setting up their community since the 1990s [4].

It is from the beginning of the millennium that the demographic increase has made itself felt in a very incisive way up to become the largest Chinese Italian community and the third European after London and Paris<sup>1</sup>. The Prato manufacture and that relating to the Chinese community traveled in many ways on different tracks with parallel skills; with due exceptions, the Chinese deal with fast fashion for medium-low markets, and Prato with increasingly high quality fabrics, the former increasing their

---

<sup>1</sup> The factors that influenced the growth of the community were China's entry into the WTO and the end of the Multifibre agreement which no longer allowed to regulate manufacturing imports from countries with non-advanced economies.

turnover a lot, the latter, instead, downsizing it. So the spaces left free by Prato in many cases were occupied by the Chinese.

In fact, there are very few elements of contact between these two realities: Italian staff with the skills of fashion designer and accountant is present in Chinese companies and as far as the processes are concerned, printing works and dyers have both Italian and Chinese customers [5].

The shortening of the design/processing times that led from fast fashion to fast fashion has exacerbated certain mechanisms and even more marks the separation between the two realities.

### 3 The Production Structure

From the beginning of the twentieth century until the Second World War, two production circuits were substantially established: that of vertically integrated companies with standardized productions (plaids, military blankets, etc.) oriented towards exports, whose greatest strength was given by the large numbers of production; that of the teams of companies with phase processing with a production more oriented towards the clothing markets.

Large full cycle companies have had a prevalent role only for fifty years, that is, from the second decade of the 1900s to the 1960s, after which they will undergo the pulverization process.

In some respects the war destruction triggered this phenomenon which then determined the identity and characteristics of the Prato model: “according to some estimates, 33% of the looms, 80% of the spinning mills, seventy percent of the assortments in operation at the beginning of the war were destroyed or damaged [6]<sup>2</sup>.”

Giampiero Nigro writes, “Starting from the 1960s, with the evolution of the role of the small business and the tumbler, the flexibility characteristics were enriched with new meanings, above all in terms of rapid adaptation of the production to the requests for textile products less and less standardized, more personalized and qualitatively better” [7].

Taking as a firm point the competitive market price deriving from the use of recycled material, production was then differentiated thanks to the production structure. So even knitwear, combed products and patterned fabrics, intended for women’s clothing, became part of the Prato products. As a result, an ever closer relationship developed with the fashion industry [8].

<sup>2</sup> It is said that some companies managed to save their frames from the destruction of the German army by dismantling and burying them. These episodes, which are still being told, are reported without documentation, also by Edoardo Nesi in the novel *Storia della mia gente* (2010).

In June 1944 at the station of Carmignano, Alighiero and Bogardo Buricchi, Ariodante Naldi and Bruno Spinelli blew up eight German railway wagons loaded with TNT destined for the destruction of Prato’s industries.

## 4 Carded: Manufacturing Cycle

From the nineteenth century, with precision between 1850–60, spinning machines began to be developed with materials obtained from the scraps and scraps of used fabrics and clothing, starting the processing of regenerated wool [9].

Carding is a specific fiber processing technique. The yarns are produced with the use of virgin fibers or through the reuse of the fibers obtained from the recycling of fabrics and from new and used knitwear cuttings.

The characteristic of this process is the use of short and even non-homogeneous fibers, mixed together in the most varied compositions such as to give the yarn a particular physiognomy that distinguishes it from the other type represented by the hairstyle.

For over a century, regenerated wool has represented an important opportunity for development and affirmation of the Prato textile district on markets all over the world.

Recycling techniques [...] collect and synthesize a culture of attention and sensitivity towards the environment, the tradition of man and his professional skills [10].

The operations that are part of the carded fabric cycle are sorting, carbonizing, tearing, carding, spinning, warping, weaving, fulling, dyeing, finishing, recovery of processing waste and new start of the cycle. They are the first four and the last, the actions that characterize it [11].

The figure that performs the actions of differentiation and selection of textile materials is the sorting machine or, more generally, the *cenciainolo* or *stracciaiolo*. Those who still carry out this job have a highly developed visual and tactile sensitivity that allows you to quickly distinguish the rags by composition and color and which for their speed and precision did not seem replaceable with an equally efficient machine. On the whole territory there are no more than forty. There is a generational change for this particular profession: they are young people from Morocco, India who today acquire this professionalism that allows you to distinguish the composition of the fabric at a touch and the nuance of the colors with your eyes (Fig. 1).



**Fig. 1.** Pieces of fabric during the selection operation

We are therefore in the presence of a productive culture that is not only based but rooted in recovery, an element which, perhaps, has not yet been given the cultural recognition it deserves.

In this direction, the initiative promoted by the Prato Chamber of Commerce, in collaboration with the Consortium for the Enhancement of Carded Textile Products, Pratese Industrial Union, CNA National Confederation of Craft and *Confartigianato*, (trade association) which established the *Cardato* brand and the *Cardato Riciclato* brand, and even if today there are not many member companies, there are some that, while applying the principles, however company policy preferred not to join the brand<sup>3</sup>.

If in the past the Prato companies had a certain homogeneity, today the companies that work on this reality are very different. In general, the awareness of wanting to enhance the historical industrial culture is growing. It is the smallest and youngest companies that manage most effectively that manage to superimpose the product on effective and very dynamic communication.

Among these, the reality Rifò can be mentioned, which also had attention in the national press despite being a small company. A network of four companies has been created with the Re-think your jeans project: used jeans are collected through the Naturasi food store network; Recooper social cooperative deals with the selection of materials; Pinori filati produces yarn from recycled material and, finally, Rifò transforms the yarn into clothing products (Fig. 2).



**Fig. 2.** Control operation on frayed fabrics

<sup>3</sup> The certification is guaranteed by SGS, the international certification body, which also guarantees a connection with fashion brands (<http://www.cardato.it/it/cardato/il-progetto/>).

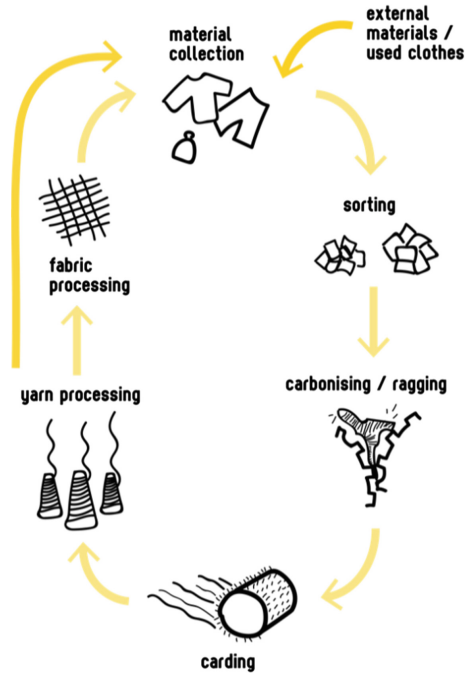


Fig. 3. Scheme of the carded regenerated cycle

## 5 The Manteco Company

Young growing companies are important to understand the creative potential that exists in the area, however our attention is right that it focuses on large companies that face the challenges of the present with a vision that knows how to keep historical heritage and future challenges together sales, for which the company purchases the “mechanical wool” spun in the various stocks and then be woven and finished according to the expected qualities; the second line consists of a wide range of fabrics produced with carded and combed virgin wool fibers; the third line is made up of fabrics of variable composition obtained through the use of worsted wool, cotton, linen and their blends. In this case the yarns are directly purchased from preferably European first-rate spinning mills.

Applications of enabling technologies, attention to the sustainability of corporate value communication are some of the most visible actions that come into contact with the company.

Let's start with the company archive set up in the last year, which organized and made the 40,000 samples accessible. Through the inventory, cataloging, digitization, conservation and display of the company's historical heritage, stylists, researchers, customers, students and journalists can consult the material on site. Each folder that collects the historical material is marked with a quarcoder that communicates the complete content to the visitor without having to take it from the shelf.

Next to the physical archive, a digital archive was set up in which there are photos of the collections of items developed over the years starting from the collections of the 1970s. Sending via e-mail photos of fabrics as an alternative to samples sent by express courier leads to high energy savings.

The sustainability of the company is not expressed only through the use of regenerated material. By way of example, we would like to mention Project 43 which is taking more and more field. This is the collection of all the fabric production scraps that occur during the cutting of the fabric by the packer. These fabric scraps, suitably selected for color and composition, are used again so as to create new fabric. It should also be added that the company is “Zero Waste” in fact.

The production waste (false selvages, test samples, piece heads, spinning and twisting scraps, etc. ...) are grouped and re-entered in the production cycle.

The commitment to sustainability and the circular economy has been recognized and rewarded: it was among the five Italian companies to receive the Radicalgreen award in 2018, within the third edition of the Green Economy Festival [12]; presented its proposals to Premier Vision in September 2019 within the section/platform dedicated to companies that work in favor of responsible innovation; has been included among the 1000 companies that inspire Europe.

They then obtained the Cribis Prime Company certification<sup>4</sup>.

There are also many projects that focus on the physico-chemical characteristics of the product. One last work carried out was the verification of the presence of bacteria in the recycled raw materials which over time deteriorated the fibers, decreasing their color fastness to light. As a result of this study, the Bacteria Free system was developed which sanitizes the fibers before spinning, making them more sanitized and leading to evident product improvements [13].

We are therefore in the presence of a territory and companies that are transforming traditional knowledge that has developed thanks to resourcefulness and know-how in a model capable of giving answers to the needs of our time.

It is no coincidence that Prato will be a “pilot city” of a national project, together with Milan and Bari, becoming a real laboratory for promoting and experimenting innovative initiatives on the circular economy and on all issues with high environmental impact on waste. The themes of circularity have always been historically linked to the city of Prato, since reuse has been the basis of the development of the textile district with the creation of recycled carded wool.

## References

1. Dal Curto B., Fiorani E., Passaro C.: *La pelle del design*. Lupetti, Milano (2010)
2. Vv.Aa.: *Sustainable Thinking*, Exhibition Catalog, Florence 2019. Electa, Milan (2019)
3. Becattini G.: *Lo sviluppo economico della Toscana: con particolare riguardo all'industrializzazione leggera*. IRPET, Firenze (1975)
4. Bonomi, A., Masiero, R.: *Dalla Smart City alla Smart Land*. Marsilio, Venezia (2014)

<sup>4</sup> Award issued to companies that simultaneously have Tating 1 (maximum level of reliability) and Paydex® >70.



5. Etnografia del pronto moda: I laboratory cinesi nel distretto di Prato. <https://journals.openedition.org/qds/379>
6. Nigro G.: Il “caso” Prato in Storia d’Italia. Le regioni dall’Unità ad oggi. La Toscana, pp. 823–868. Einaudi, Torino (1986)
7. Nigro G.: Il “caso” Prato in Storia d’Italia. Le regioni dall’Unità ad oggi. La Toscana, pp. 823–868. Einaudi, Torino (1986)
8. Cardato made in Prato. <http://www.cardato.it/it/cardato/il-progetto/>
9. Prato arte e storia. <http://www2.po-net.prato.it/artestoria/storia/memorie-tessile/dizionario/pagina448.html>. Accessed 30 Jan 2020
10. Magi F., Ceccarelli F.,: Il cardato pratese. La spola, Prato (2002)
11. Ricchetti, M. (ed.): Neomateriali nell’economia circolare. Moda. Edizioni Ambiente, Milan (2017)
12. Greenweek festival della green economy. <https://www.greenweekfestival.it/premier-gentiloni-premio-radical-green-aprono-la-green-week/>
13. Mantellassi Compagnia tessile. <https://www.manteco.com/prodotti-eco-friendly/>