Circular Economy and the Fashion Industry: insight from the Prato.

A case study of Circular Industrial District

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Introduction

The global apparel industry is valued at USD 1.79 trillion and employs 430 million people around the world (Cardona, 2024). According to the European Commission (2022), garment production doubled in size in the last decade, driven by global patterns of overproduction and overconsumption known as '*fast fashion*'. This term is used to describe a business model based on inexpensive and widely available of-the-moment garments which encourages frequent purchase and ensures rapid stock turnaround (Bick *et al.*, 2018; Taplin, 2014). The fast fashion industry typically configures a high level of globalization and fragmentation, featuring tiered production chains that comprise as many as hundreds of firms spread across dozens of countries (Ghemawat & Nueno, 2006; Bhardwaj & Fairhurst, 2009; Gereffi & Memedovic, 2003). While this model might have contributed to an alleged "democratisation" of fashion, the social and environmental risks associated with cheap clothing production, consumption and disposal are the undeniable proof of the unsustainability of the model (Bick et al., 2018; European Commission, 2022; Ellen MacArthur Foundation, 2017). Despite this, the consumption of textiles continues to grow and is expected to increase by 63% in 2030 (European Commission, 2022), while clothing sales should reach 160 million tonnes by 2050 (Ellen MacArthur Foundation, 2017).

Given the globalized nature of the textile fashion supply chain, the geographical dimension cannot be excluded from our analysis of the environmental impacts. Inspecting where and at what scale these impacts take place is crucial to gain a clearer understanding of the unsustainability as well as the inequity that feature this industry. Research shows that environmental impacts are spread throughout the entire supply chain, but the most hazardous ones – i.e. those connected to production and disposal – are unevenly distributed worldwide, with developing countries bearing the burden for developed countries. Production and manufacturing mainly occur in Asian territory, where almost half of the local-water-use impacts of cotton cultivations are caused by foreign demand (Niinimäki et al 2020). The Aral Sea in Central Asia represents one of the most prominent examples, having shrunk to just 10% of its former volume, mainly due to irrigation for cotton farming (Chen, 2018). Disposal (mostly in landfills) and its impacts are also concentrated in few regions, mainly in Sub-Saharan Africa and South America.

A similar process of international outsourcing involved the last phase of clothing's lives, namely waste management and disposal. Along with the rise of the "*throwaway fashion*" system, a proper second-hand industry has developed, fuelled by enormous quantities of clothes tossed away after a few years of use. The majority heads abroad, joining a global second-hand trade in which billions of old garments are bought and sold around the world every year (Rodgers, 2015).

The EU policies leading to circular transition in the fashion industry

The European Union's transition towards a circular economy began significantly with the first Circular Economy Action Plan in 2015 (European Commission, 2015) significantly boosted with the European Green Deal (European Commission, 2019). In the new Circular Economy Action plan issue in 2020 a specific action was the adoption of measures to promote sustainable products, consumer empowerment, and a strategies for circular The European Strategy for Sustainable Textiles was adopted in 2022 and

included a set of initiatives: (a) ecodesign requirements ensuring textiles are long-lasting, repairable, and recyclable; (b) the ban on destroying unsold textiles enhancing transparency and preventing waste; (c) tackling microplastic pollution hence reducing synthetic fibres and other mitigating measures to reduce releases of microplastic in the environment; (d) the Digital Product Passport to better inform consumers about sustainability; (e) tackle greenwashing to ensure accurate sustainability claims; (f) harmonize the Extended Producer Responsibility (EPR) regulation. Between 2021 to 2025 the legislative work of the EU issued two major legislative actions affecting the fashion industry: the revision of the Ecodisgn Directive transforming it into the Ecodesign for Sustainable Products entered into force in July 2024; the revisions to the Waste Framework Directive on Textile adopted in February 2025. These two acts affect directly the fashion industry and the whole supply chain. It introduces harmonized and binding targets for textile waste management, emphasizing waste prevention, EPR, and increased recycling rates. It also establishes a harmonized definition of waste, a waste hierarchy prioritizing prevention, and stronger enforcement measures. Additionally, the Ecodesign for Sustainable Products Regulation broadens sustainability requirements across multiple product categories, provides elements to calculate the fees within the EPR textile systems, introduces the Digital Product Passports and bans on the destruction of unsold products. In the meantime, JRC (2024) and the European Commission (2019) they are developing a harmonized End-of-Waste (EoW) technical regulation to clarify when waste ceases to be waste, reducing legal uncertainties and market distortions. Specifically, the work on the Reach regulation, Finally, on the EU taxonomy, on Greenwash, on Green Claims and in sustainability reporting (Corporate Sustainable Reporting Directive) and the so-called Corporate Sustainability Due Diligence Directive, thought acting along the supply chain further is affecting the firms in the sector that strives to achieve circularity with various perspectives.

A territorial perspective and the circular industrial district: the case of Prato

Although Circular Economy has grown interest in academia and on policy agendas, this model is far from being fully developed in practice and it has to be fully studied in its implications to better tackle social and environmental challenges. In this perspective we deem that the the case of the very well-known industrial district of Prato, iconically represented and studied by Giacomo Becattini in its seminal works (Becattini, 1989), might represent a significant case study with the aim of understanding and identifying the spatial, urban, geographical, regional dimensions of circular economy, potentially integrating multiscalarity.

In this perspective this paper present the case study of Prato as the archetype of circular textile industrial district and its evolution, facing complex challenges to manage and adapt to EU new set of legal requirements that can be compared to the impact of globalisation and increased trade liberalisation on European regions of the early 2000s (Grandi et al, 2008) in the transformative effect of its socio-economic local system.

In particular, the study of Prato first helps to depict the circular potential of the textile and clothing system building in its historically and socio-economic structure. Prato is one of the most relevant textile hubs in Europe. The specialization in textile production can be traced back to the XII century, when the manufacturing activities were regulated by the medieval wool corporation, called "Arte della lana" (Confindustria Prato, 2024). The industrial take-off started out towards the end of the 19th century, thanks to the affirmation of mechanical processes in local factories, which favoured capitalist intensification and accumulation processes. In this context, the first companies emerged and thrived around the production of "*cardato*" wool – obtained through the mechanical recycling of used textiles and scraps – which became the distinctive product of the area. During the 1970s, the industrial district model, characterized by a flexible and ready supply-chain, becomes the prominent form of productive

organization in Prato. The district perfectly adapts to the fast-changing market, shifting from wool-production centre (product-oriented) to innovative fashion-and textile-hub (market-oriented) (ibidem).

Starting from the second half of the 1980s, the Prato industry experienced (in line with other Italian districts) a gradual decline, which grew worse with the beginning of the new millennium. The size of the local textile industry has substantially decreased compared to the one of 50 years ago and today, the remaining firms are trying to restructure and align to the features of a new market. Many companies in the district increased their competitiveness through a restructuring process of eco-innovation in reaction to the changing market and the crisis of the industrial cluster. With the term "eco-innovation" we refer to the "production, assimilation or exploitation of a product, production process, service or management or business method that is novel to the organisation (developing or adopting it) and which results, throughout its life cycle, in a reduction of environmental risk, pollution and other negative impacts of resources use (including energy use) compared to relevant alternatives" (Kemp & Pearson, 2007).

Eco-innovation can be a powerful approach towards circular economy because it has the potential capability to lead to win-win situations, in which economic growth and enhanced environmental quality coexist (Mazzoni, 2020). Not every eco-innovation is directly linked to circular economy and not every dimension of circular economy requires innovation, but there is no doubt that these two practices influence one another. Today, Prato leads the way in fibre regeneration, involving 7 000 firms, each handling a specific phase of the process. Every year more than 100 thousand tons of used clothing and textile scraps are recycled (CORETEX, 2024), making Prato an outstanding example of textile circular economy and thus, an intriguing case to study.

The field visits and interviews conducted highlighted both benefits and challenges related to circular economy in the fashion industry. While the benefits of more sustainable and circular textiles – such as fabric-to-fabric recycling or reuse – seem evident, a number of challenges persist and deserve more attention and discussion. First, it emergers that circular design is rarely applied to textiles, which makes it difficult to source recyclable and reusable inputs for companies involved in these processes. Regenerated cashmere is one of the most significant value-added circular productions, however the cycles does not start yet from the initial design, but it is related to material recovery from scrap or high quality cashmere textile waste imported from the United States. Another fact hindering recycling. The detachment between product development and supply chain processes, typical of the fashion industry, entails a huge loss of value at the end of life. At the time being, recycling is still a challenging process, and few companies are eager to undertake this path from scratch. Second, worries on the effect of Reach legislation might lead to new challenges to circular economy. This is related to many of the chemicals and synthetic fibres used to manufacture textiles bring various advantages, including water or stain repellence and durability. An example is the treatment of textiles with formaldehyde to make them "non-iron" or crease resistant or the use of PFAS (forever chemicals) in water repellent treatment. These substances are classified either carcinogenic and is linked to allergic contact dermatitis (Ellen MacArthur, 2017) or of very high concerns in Reach regulation hindering the actual possibility of creating new products for the market. The third main challenge is related to the structure of the EPR system and their models that member states are going to adopt. It emerges a significant concern related to the impact in the supply chain. In particular, the positions of large scale and brand-led companies, that do not have yet circular economy experience, and small and medium size companies localised in the industrial district have different views in the implementation of the EPR system. Therefore, there is a significant time-lag to expect to the new circular ideally transition envisioned by the EU policies. However, a new phase of evolution is currently unfolding, once again reshaping the industrial district. Nevertheless, if Becattini's traditional model (Becattini, 1989) can be applied to the concept of the "circular industrial district," Prato is likely to adapt and transform, driven by its inherent resilience.