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Fashioning Circular Fashion: A Transformative Challenge across the European Fashion System

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Abstract

Today, we are witnessing a shift in the fashion industry's production paradigm. The impact of different processes along the supply chain is evident. Consumers have started to turn towards brands that invest in effective organizational strategies and supply chain management models that consider their effect on the planet and respect for people. The circular economy is widely recognized as the main business model addressing the highlighted issues in the fashion industry. However, there still needs to be a gap in the environmental, economic, social, and cultural sustainability levels achieved when this model is implemented. In her Ph.D. research, the author investigated this specific dimension of sustainable development, the implementation of the circular economy model in the fashion system, which can take place through the adoption of systemic and project-based actions involving the entire supply and value chain from workers to companies. Working within the analyzed context, from production to the market, the paper illustrates the identified directions that strategically incorporate design-driven solutions to achieve sustainability goals through practices and processes to establish effective and responsible recycling, remanufacturing, and reuse paths.

Keywords: Fashion Design for Sustainability; Circularity; Innovation; Paradigm Transition; Industry transformation.

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Introduction

Today, every industrial sector is working to reduce its impact on the ecosystem, understood broadly as people, economies, and the planet. Since industrialization, human activity has profoundly altered the climate in unprecedented ways. As a result, we can exceed the 1.5-degree limit as early as the 2030s.[1] Scientists warn that humanity has hesitated too long and done too little. As evidence of this, we are witnessing record heat waves, raging fires, and unpredictable and widespread flooding that are evidence of climate change. Scientists have called on world leaders, governments, and businesses for years to take more stringent action quickly.

In the presented context, fashion has a leading role as a multi-billion-dollar global industry dedicated to business out of the Planet's finite resources.[2] Here the sector is understood as a unicum, and there is no separation between fashion and textiles. It deals with the design and production of garments, their distribution and use, and the design, production, and distribution of yarns and fabrics. What distinguishes this industry from other production sectors is that the same intention governs its primary and end products: change. Bertola[3] stated that fashion encompasses a multidimensional universe representing a complete expression of postmodern industrial culture. In this sector, hyper-consumption and the shortening of product life cycles, combined with population growth and economic development, generate a triple effect, further increasing environmental, economic, and socio-cultural challenges.[4]

From an environmental point of view, the fashion industry significantly impacts resource consumption and the return of these resources in the form of pollution.[5] Various environmental issues, such as the use of chemicals, environmental degradation, and water pollution, are linked to the industry. For example, it takes 2,700 liters of water to make one cotton shirt, enough to meet the average person's drinking needs for two-and-a-half years. Also, manufacturing a pair of jeans produces as much greenhouse gas as driving a car more than 80 miles, and the discarded clothes — made of non-biodegradable fabrics — can sit in landfills for up to 200 years, releasing harmful substances into the soil when exposed to the atmospheric agents.[6] The industry acts on people, communities, and territories in the social and cultural spheres. Socio-cultural issues such as low wages, child labor, or the violation of labor legislation are also connected to this industry, as well as the problems related to the conservation and regeneration of the meanings embedded within the traditional processes and practices of craft.[7] These situations occur mainly in the low-income countries of the global South, where most clothes are produced. These areas are unfortunately notorious for past industrial accidents, such as the Rana Plaza collapse in Bangladesh in 2013. The building housed five garment factories, and the collapse killed at least 1,132 people and injured more than 2,500.[8] These unsustainable phenomena are related to the fashion industry's current

1. IPCC, *Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, eds. Hans-Otto Pörtner, et al. (Cambridge and New York: Cambridge University Press, 2022).

2. Kirsi Niinimäki et al., "The environmental price of fast fashion," *Nature Reviews Earth & Environment*, Vol. 1.4 (2020): 189–200; Mukherjee Sudeshna, "Environmental and social impact of fashion: Towards an eco-friendly, ethical fashion," *International Journal of Interdisciplinary and Multidisciplinary Studies*, Vol. 2.3 (2015): 22–35.

3. Paola Bertola et al., "The cultural dimension of design-driven innovation. A perspective from the fashion industry," *The Design Journal*, Vol. 19.2 (2016): 237–251.

4. Gustav Sandin, and Greg M. Peters, "Environmental impact of textile reuse and recycling–A review," *Journal of cleaner production*, Vol. 184 (2018): 353–365.

5. Ellen MacArthur Foundation, "Circular fashion—A new textiles economy: Redesigning fashion's future," accessed February 17, 2023, https://www.ellenmacarthurfoundation.org/assets/downloads/publications/A-New-Textiles-Economy_Full-Report_Updated_1-12-17.pdf.

6. Elizabeth Reichart and Deborah Drew, "By the numbers: The economic, social and environmental impacts of fast fashion," accessed September 20, 2023, https://www.wri.org/insights/numbers-economic-social-and-environmental-impacts-fast-fashion?_ga=2.67275857.1.

7. Sass Brown and Federica Vacca, "Cultural sustainability in fashion: reflections on craft and sustainable development models," *Sustainability: Science, Practice and Policy*, Vol. 18.1 (2022): 590–600.

8. Rashedur Chowdhury, "The Rana Plaza disaster and the complicit behavior of elite NGOs," *Organization*, Vol. 24.6 (2017): 938–949.

developing linear model. Such a model dominates the fashion system and is based on the notion that resources are infinite and perpetuates a take-make-waste scenario that stimulates overconsumption and the shortening of production and product life cycles.[9]

The presented scenario shows how the development of the fashion industry, the rapidly changing trends, the mass production model on a global scale, the extension of production to developing countries, and its consumeristic vocation have contributed significantly to increasing unsustainability concerns.[10] According to this, the need to review linear development paths emerged to act on the fashion industry's impact. Despite the environmental, social, and economic concerns, many efforts are still needed. Sustainable objectives can be achieved by adopting alternative development frameworks such as the circular one. Today, the closed-loop model is recognized as capable of decoupling sustainable fashion innovation from ecosystem exploitation.[11] For many fashion brands, the circular economy is emerging as a priority, and they are striving to reduce resource use, carbon emissions, and waste. Despite this, the fashion industry's criteria for transitioning to the circular economy are relatively unexplored. This means that the sector poorly understands the concept of circularity, which often confuses sustainability principles with those of the circular economy. These two approaches differentiate because sustainability sets open objectives, whereas the circular economy focuses on closed-loop systems. Furthermore, it is becoming increasingly clear that the circular economy is often misunderstood as a simple action on waste management, which hinders the application of circularity principles in the fashion industry.[12]

In this context, the author starts from the key points that emerged from the first phase of her doctoral research to trace new trajectories for development. This paper investigates how, from a design perspective, new paths are being defined in the contemporary fashion industry to contribute to developing a closed-loop system in which the goal is to recycle, remanufacture, and reuse resources in multiple stages of the supply chain.[13] The design-driven lens is fundamental to strategically capitalizing on the richness and variety of systems that govern a company. It enables a purpose-driven, holistic approach to circularity, which can help negotiate an achievable goal between companies, stakeholders, and the community, driving the company forward.[14] Accordingly, the research here presented responded to specific objectives related to (1) identifying how fashion companies approach sustainability by engaging in circular practices for preserving resources and (2) codifying current strategies for building alternatives to the highly impactful processes on which fashion products rely.

Methodology

The paper aims to present the results of the first part of the author's doctoral research. This step resulted in an investigation of how European fashion companies pursue circular initiatives, making it possible to create strategic actions that stimulate new interactions and processes along the supply chain. The data analyzed were extracted from the doctoral research of the author[15] and integrated with data from the

9. Kanchana Dissanayake, and Dakshitha Weerasinghe, "Towards circular economy in fashion: Review of strategies, barriers and enablers," *Circular Economy and Sustainability*, (2022): 1–21

10. Stella Claxton and Anthony Kent, "The management of sustainable fashion design strategies: An analysis of the designer's role," *Journal of Cleaner Production*, Vol. 268 (2020): 122112.

11. Cristina Dan and Thomas Østergaard, "Circular fashion: The new roles of designers in organizations transitioning to a circular economy," *The Design Journal*, Vol. 24.6 (2021): 1001–1021; Ramasamy Rathinamoorthy, "Circular fashion," in *Circular economy in textiles and apparel*, ed. Muthu Subramanian Senthilkannan (Sawston: Woodhead Publishing, 2019), 14–48.

12. For further discussion of this problem see Dissanayake and Weerasinghe, "Towards circular economy," 1–21.

13. Subramanian Senthilkannan Muthu (ed.), *Sustainable innovations in recycled textiles* (Cham: Springer, 2018)

14. Cinzia Battistella, Gianluca Biotto and Alberto F. De Toni, "From design driven innovation to meaning strategy," *Management Decision*, Vol. 50.4 (2012): 718–743.

15. Erminia D'Itria, *Driving sustainability in fashion through design. Experimenting with the role of design in the development of a circular fashion supply chain model*. Doctoral Thesis, Politecnico di Milano, 2022.

knowledge repository produced by the Fashion in Process — Research Lab. at the Design Department of Politecnico di Milano of which the author is a member. According to the authors' investigation, a mapping of design-driven circular practices of European fashion companies is carried out through an iterative process: an initial desk research phase followed by applying a case study methodology. The process made it possible to narrow the research field by clustering the themes from the analysis. This codification supports the research in identifying the main approaches to circularity that inform the solutions for addressing sustainable development issues. The definition of the directions made it possible to identify the study's boundaries. Among the case studies identified, a selection of good practices is presented. The author focuses on specific cases and uses them as an example of the context of interest.[16] As McGloin[17] discussed, a case study offers a creative and credible approach to help underpin contemporary practices.

Methodologically, three phases were conducted to build on new knowledge: (1) the first phase was desk research to identify current initiatives in the fashion industry, mapping current circular practices and selecting best practices; (2) the second phase was an in-depth qualitative analysis of the best practices identified during the desk research; (3) the third phase integrated all the collected data to define the evolving directions for implementing circularity through methods of recycling, remanufacturing and reusing at multiple stages of the supply chain, from design to retail and waste collection. The mapping and further qualitative research phases occurred from May 2019 to June 2020.

The mapping led to the identification of 186 companies located in 22 nations in the European continent, which have addressed aspects related to new sustainable development models by using circularity in their practices (Fig. 1).

The specific choice to investigate the European region was dictated by the exciting context in which a substantial transformation is occurring linked to the political initiatives for the sustainable change of the examined sectors.[18] Also, reasons for geographic proximity were evaluated due to the spread of Covid-19 limitations and further supported by past experiences collaborating with local companies. The companies' composition included fashion (understood in a broad sense that incorporates clothing, accessories, and footwear) (80%) and textiles companies (20%). Furthermore, most of these companies were SMEs: Micro (53%), Small (30%), Medium (9%), and Large (8%). These data are coherent with the continental industrial development trend (Black et al., 2019). Of these 186 companies, 48 were selected as case studies.

The selection of the case studies was based on several factors (Fig. 2): (1) the commitment these companies place on proactively meeting the new sustainability demands of their stakeholders, (2) how they pursue strategical implementation of sustainable practices within their system by adopting a design-driven approach that means generating ideas that are humanly desirable, technologically feasible, and financially viable, and (3) the scalability of the proposed solutions.

The following phase consists of further desk analysis to explore selected companies in-depth. Such a phase allowed for exploring possible theoretical relationships and a deeper understanding of the subject through these case studies.[19] During this further qualitative phase, the author performed face-to-face interviews with six representatives from the mapped companies. Table 1 reports the anonymized companies according to the research protocol to avoid bias.

16. Winston Tellis, "Introduction to case study," *The qualitative report*, Vol. 3.2 (1997): 1–14.

17. Sarah Mcgloin, "The trustworthiness of case study methodology," *Nurse researcher*, Vol. 16.1 (2008).

18. European Commission, "Un Green Deal Europeo," accessed February 20, 2023, https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_it.

19. For further discussion of this problem see Tellis, "Introduction to case study," 1–14.

Figure 1. Geographical map of the sustainable company analyzed

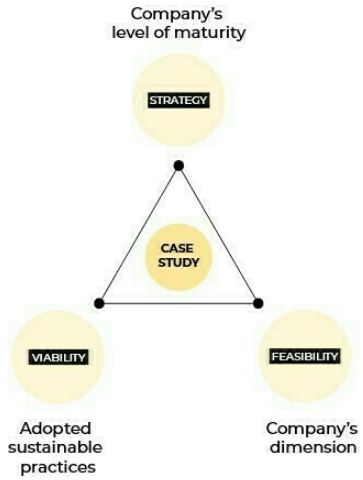

Figure 2. Case studies criteria selection

Table 1. List of the interviewed companies

List. Code	Country	Focus	Description	Size	Established
C1	Belgium	Textiles	Recycling garments with high quality and at an industrial scale because of simple disassembly tech	Micro	2017
C2	Estonia	Apparel	A fashion company that is completely focused on Design-Industrial Upcycling practices	Small	2002
C3	Italy	Shoes	Working to implement sustainable, productive practices to release the world's most sustainable shoes	Small	2015
C4	Italy	Apparel	Online sales of fashion, luxury, and design goods	Large	2015
C5	Ireland	Apparel	Collaborative consumption through a clothes sharing platform	Micro	2013
C6	Sweden	Textiles	Working to develop innovative technological solutions to regenerate cotton/cellulose clothing textile waste through a chemical recycling process	Small	2015

The interviewees were selected according to four main criteria: (1) The person's background that positions them in a specific moment of the supply chain that the research aims to explore; (2) the company reputation that met the evaluations and expectations of the research, towards the company, based on the company's history, public relations and conducted over time; (3) the efficiency of their outcomes that allow them to report their engagement; and (4) their sustainable initiatives that efficiently improved their performances moving away from greenwashing. The third phase focused on data interpretation. This phase further supported the author in identifying the directions companies follow when working on design-led sustainable practices to move towards new circular development models. These actors aim to improve the use of available resources addressing the concept of waste recovery and leading towards circularity, decoupling economic growth from increasing environmental problems. The companies involved imagine and implement processes and practices with sustainability characteristics following three specific directions during different stages of the supply chain: (1) recycling/sourcing — redesigning materials, products, and services so that they are less impactful in their exploitation of resources; (2) remanufacturing/manufacturing — re-integrating resources, without destroying them, to create products that have more value; (3) and reusing/marketing and sales — making products and values last by transferring them to another user.

Codifying Circular Directions: Findings from the Case Studies

Building on what has been discussed so far, this paper codifies the data collected to identify directions driving current design-led practices in the field of circular development of the fashion industry. This section will discuss the results of the methodology by presenting the three identified directions: recycling/sourcing, remanufacturing/manufacturing, reusing/marketing, and sales.

These directions could promote new perspectives in sustainable fashion design. This document aims to define the potential paths to reduce the consumption of raw materials, design products with a longer life cycle, and how they are addressed to ensure sustainable development.

From an operational point of view, the work has identified three macro themes in the approach to sustainability through circular practices that emerged from the debate on the conservation of resources and the maximization of the use of products. As discussed in the literature,[20] it is evident that strategies develop that preserve economic activity and manufacturing practices while building new directions in understanding possible alternatives to the highly impactful processes on which their products are based. This becomes a means to develop longevity solutions or educate consumers to enable forms of preservation of goods and resources and positively impact the supply chain.

These strategies move in a common path based on safeguarding and protecting the resources available but present different directions on how companies put these actions into practice along the supply chain and in the related production, distribution, and management processes.

Companies like Renewcell,[21] Acquafil,[22] or ASTRI[23] are improving their strategies to capitalize on the circular nature of their know-how that has generated their products or services. They carry out actions to develop systems for building recycling paths to preserve the material resources on which their business is based. On the other hand, Ganni, Raeburn, and Garbage Core develop manufacturing-driven solutions to bring circular innovation to their supply chains. Other cases implement sustainable development by shifting their practices to reusing the existing and emphasizing their environmental care. Platforms like Vestiaire Collective and Tissu Market,[24] or franchising such as Humana Vintage,[25] face targeted operations to work with companies and consumers to recover resources and goods they use to realize their service/business. We then discuss strategies with a common model of resource sustainability, but the study examined how the identified directions differ (Fig. 3).

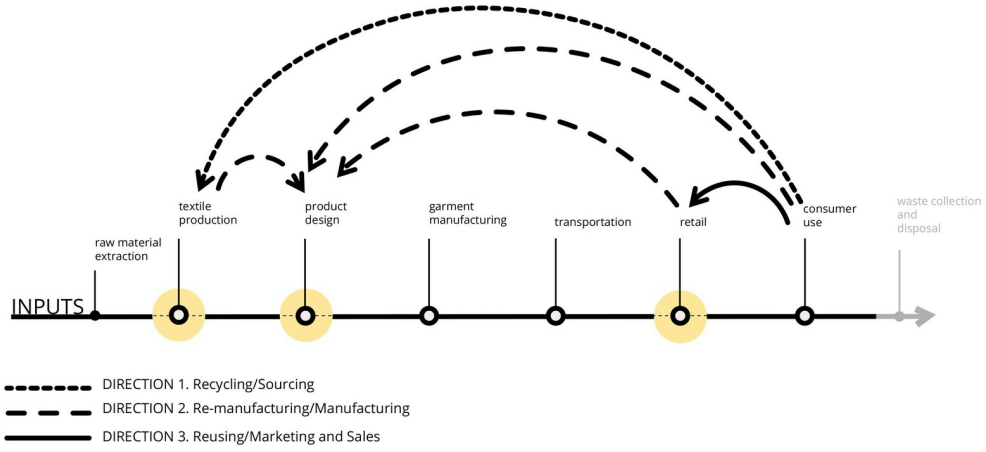

Figure 3. Circular Directions

20. Emelie Hultberg and Rudrajeet Pal, "Lessons on business model scalability for circular economy in the fashion retail value chain: Towards a conceptual model," *Sustainable Production and Consumption*, Vol. 28 (2021): 686–698.

21. ReNewcell, "ReNewcell – We make fashion circular," accessed February 18, 2023, https://www.renewcell.com/en/.

22. Astri Recycling, "La nostra mission," accessed February 18, 2023, https://astrirecycling.it/.

23. Aquafil SpA, "La nostra visione," accessed February 18, 2023, https://www.aquafil.com/it/.

24. Tissumarket, "Vente de tissus au mètre," accessed February 18, 2023, https://www.tissumarket.com/.

25. Humana Vintage, "Humana Vintage," accessed February 18, 2023, https://humanavintage.it/.

Starting from what has been presented, the research offers an in-depth analysis that aims to provide a more extensive description of the behaviors identified in the case studies. However, the author recognizes that there are limits within which codified behaviors are interpreted.[26] Even if the different cases follow a guideline we could define as standard, they are to be understood in the specificity of their context, territory, and actors involved.

Among the 48 case studies identified, a selection is explored in the following section to discuss how different directions could be found among those identified.

Recycling/Sourcing

The first direction codifies the strategies adopted by the fashion industry to capitalize on the recovery of resources through the practice of recycling, be it mechanical or chemical. Waste is recognized here as an asset for the company. This waste can be either pre-consumer materials, created during the manufacturing process before their delivery to a consumer, or post-consumer materials, which have already experienced a life cycle and are produced by the end consumer of a material stream.[27] Companies in this category develop production practices that preserve resources by enhancing recycling processes, often enabled by a technological medium.

Renewcell is a Swedish-based company founded in 2012 by a group of innovators from the KTH Royal Institute of Technology in Stockholm. The sustainable technology company pursues an evolutionary vision of the industrial system toward a circular world that enables sustainability paradigms by producing high-quality materials from recycled textiles.[28] Renewcell has patented its process that enables cellulosic textile waste, such as cotton clothes or denim jeans, to be recycled into a new and pristine material called Circulose®. The company saves resources by improving the classic recycling process and innovating it through the medium of technology. When the garment reaches its end of life, Renewcell prevents it from ending up in a landfill or incinerated by providing a recycled cotton or viscose material with a satisfactory quality on a large scale. Their recycling technology dissolves used cotton and other natural fibers into a new biodegradable raw material, Circulose® pulp, which can make virgin quality biodegradable viscose or lyocell textile fibers. The collected fabrics are prepared through a cleaning and decolorization process to obtain a pulp. The resulting pulp is then purified of any non-cellulosic content and dried, in sheets, to produce a pure and natural dissolving pulp made from the fabrics, thus completely recycled. The resulting sheets are baled and fed into the production chain to replace virgin materials such as cotton. Through this process, the company provides a real recycling alternative to enable closed-loop processes. Another company that is working in this direction is Aquafil. Founded in 1965 in northern Italy, Aquafil is an innovative leader in producing and distributing polyamide 6 worldwide. In 2011, after years of research and development, Aquafil launched its leading project, the ECONYL® regeneration system. This system has enabled the company to transform Nylon 6 waste into regenerated nylon with the same level of quality and performance as standard nylon. Collected waste from all over the world and from different sources such as fishing nets, carpets, textile, and plastic industry waste is cleaned, and those that are still usable are fed into the company's patented regeneration process to obtain nylon polymer and nylon thread. From there, the material obtained can be reused within the production processes. ECONYL® regenerated nylon enables fashion brands to create new products responsibly and circularly. One example is the partnership with Prada, which used the yarn produced by the company to launch its sustainable Prada Re-nylon line. Nylon is a material that is representative of Prada, and through its partnership with Aquafil, the brand has converted all virgin nylon production into regenerated nylon. Aquafil, therefore, works on recovering waste, both pre-consumer and post-consumer materials, to reintroduce them into the material flow and optimize resource utilization to

26. Marilyn K. Simon and Jim Goes, *Dissertation and Scholarly Research: Recipes for Success* (WA: Dissertation Success, 2011).

27. Tanya Domina and Kathy Koch, "The textile waste lifecycle," *Clothing and Textiles Research Journal*, Vol. 15.2 (1997): 96–102.

28. Doina I. Popescu, et al., "Innovative Models For Approaching Managerial Practice," *Proceedings of the International Management Conference* (Faculty of Management, Academy of Economic Studies, Bucharest, Romania, 2021): 583–588.

enable closed cycles of production and consumption. Another reality that moves along this path but focuses its processes on the mechanical dimensions is the ASTRI consortium. The Italian recycled textile association was born to enhance Prato's expertise in producing regenerated fabrics. Utilizing the knowledge of the practices of the *cenciaioli*, figures dating back to medieval times, old textiles are collected and regenerated. The process involves the mechanical breakdown of post-industrial or post-consumer waste into products with different physical properties. The collected materials are sorted by color, cut, and shredded to be reconverted into cotton or wool fibers, depending on the garment processed. The resulting materials are then transformed into yarns, ready to make new garments. Specifically, the process generally includes the following steps:[29] (1) manual sorting of fiber by color to ensure that the fabrics received meet the raw material specifications and eliminate the need to re-dye the fabrics; (2) shredding involves the removal of components that could interfere with the recycling process as they pass through numerous cylinders filled with sharp points, which break down the fabric into fine flakes; (3) combining is necessary to compensate for the fibre degradation that occurs during the shredding process, the recovered fibres are often shorter than their virgin equivalents and are therefore combined with virgin fibres to improve the properties of the final recycled yarn; (4) carding is used to comb the material to produce a webbing called ribbon which can then be (5) spun to twist the fibres and obtain yarn and finally (6) woven to produce the formation of the interlacing of a series of parallel threads with a continuous thread according to a predetermined weave and are carried out using hand or mechanical looms. Such a process contributes to the move toward a circular economy.[30] It reduces the production of new textiles from virgin materials and preserves basic resources such as water, energy, and chemicals in the production chain.[31]

All the companies working on this first path recognize recycling as essential to the long-term sustainability of businesses. They rely on circular processes enabled by both traditional and technology-driven practices. They invest in the industry of the future and provide designers with new resources to make their products using materials with inherent sustainability attributes.

In the presented scenario, it is important to underline also the critical issues relating to these companies' practices. Factors such as (1) size and scale of businesses — most companies are small/micro, and their size makes it difficult to establish themselves in the global market — and (2) current legislation limitation — some companies have to deal with existing legislation in their countries to control environmental protection measures and limitations in the waste management and reuse.

Re-manufacturing/Manufacturing

The second direction refers to the rising strategies adopted by the fashion industry for capitalizing on the specific know-how that generated their products. Companies are implementing circularity by shifting their practices and working on their attributes of care for resources, materials, and final products. This direction is oriented towards the preservation of materials through a design approach that emphasizes reworking and putting products back into the production cycles. The relationship designers establish with the product is one of recovery through creative solutions based on their knowledge and techniques.

As Marques et al.[32] discussed, designers characterize these processes through their skills and creative intelligence. These cases are distinguished by their approach to rethinking the logic of consumption within the fashion segment. In this sense, in no case are fashion products considered waste.

29. Burçin Ütebay, Pınar Çelik and Ahmet Çay, "Effects of cotton textile waste properties on recycled fibre quality," *Journal of Cleaner Production*, Vol. 222 (2019): 29–35.

30. Julia Baruque-Ramos, et al., "Social and economic importance of textile reuse and recycling in Brazil," *IOP Conference Series: Materials Science and Engineering*, Vol. 254 (2017), 1–9.

31. Helena Dahlbo, et al., "Increasing textile circulation—Consequences and requirements," *Sustainable production and consumption*, Vol. 9 (2017): 44–57.

32. António Dinis Marques, et al., "From waste to fashion—a fashion upcycling contest," *Procedia CIRP*, Vol. 84 (2019): 1063–1068.

Companies like Ganni started to embed such concepts by making small upcycling collections as part of their commitment to work towards a circular approach. They are making it a regular part of their business, not just a marketing pod. Hence, the Re-Cut collection starts from the brand's archives, searching for contrasting prints and unique fabrics to create new pieces incorporating Ganni's signature motifs, such as plaid and leopard print. The Re-Cut collection was conceived during the COVID-19 lockdown to develop new pieces without producing new fabrics. Furthermore, the Danish brand has partnered with Ahluwalia, a fashion brand designed by London-based designer Priya Ahluwalia. The goal of this collaboration, which has already reached its second edition, is to produce reworked fabric and upcycled garments from the brand's dead stock. The Italian brand Garbage Core works in the same area. This is a project of handmade and one-of-a-kind garments and accessories made from upcycled clothes that the founder, Giuditta Tanzi, finds in second-hand markets. Once the garments on which to intervene have been identified, the designer stitches, unstitches, or disassembles the clothes using her body as a mold to create new shapes and dresses. This approach to remanufacturing places the designers in a highly centralized role. They are called upon to carry out all tasks from procurement to design and production to putting resources back into the production and consumption flows. Suppose the cases presented so far remain with their practices within the fashion sector, moving along the supply chain for their procurement. In that case, the brands that operate in the second path identified often also work in an extra-sector logic, as in the case of Christopher Raeburn. The British designer founded his eponymous brand with responsible fashion design and pioneered reworking surplus fabrics and garments to create distinctive and functional pieces. Among the different sources of supply are parachutes, lifeboats, and brake pads transformed into jackets and t-shirts like the ones presented at Pitti 98.

The action carried out by the brands and companies operating in this category makes tangible the idea that in fashion, nothing is created or destroyed through design-driven operations that circularly rethink the production process of the entire supply chain.

Also, in this category, some criticalities are identified, such as the need for low-cost products that must be balanced against producing good quality products. Companies must also differentiate themselves and their products from the competition. Furthermore, the fast fashion paradigm imposes its own time constraints and unsustainable standards.

Reusing/Marketing and Sales

The third direction addresses new strategies that move towards a performance that allows companies to be more competitive with a significantly reduced consumption of resources and without externalizing waste and risk costs.[33] Companies are preserving resources by relying on what already exists and maximizing the lifecycle of fashion products.

Companies in this category are developing new offers for the market that engage stakeholders all along the supply chain in peer-to-peer experiences of goods exchange. These companies move both in the physical space, providing commercial spaces, and through the digital medium, enabling new fruitions of fashion products.

Brands such as Vestiaire Collective or Tissu Market base their development model on providing services that enable the reuse of existing resources.These are online and offline marketplaces for buying and selling second-hand goods. The first one engages virtually the final consumer by offering used luxury fashion items, such as clothes, bags, shoes, and fashion accessories. On the other hand, the second company operates in the phygital world, involving consumers, companies, and designers who can use the shop and platform to obtain deadstock and production waste from major textile companies and fashion brands. Vestiaire Collective platform works like a normal online shop, allowing the users to choose the product they want, add it to the shopping cart, and proceed to payment so it can be shipped. This company's model is characterized by its collaborative consumption vocation and the desire to create a community of peers interacting through the platform. The community evaluates users according to

33. Walter R. Stahel, "The performance economy: business models for the functional service economy," *Handbook of performability engineering*, (2008): 127–138.

their performance to obtain the various seller badges (from trusted to expert), and the participants are constantly monitored to ensure reliability. Also, the platform has a team of experts dedicated to identifying counterfeit garments, guaranteeing the authenticity of the products, and fighting the counterfeit market. Tissumarket was created in France in 2010 to develop an innovative space dedicated to fashion professionals. It is a 500 M2 workshop and exhibition space that provides designers with all the tools they need to create and realize their projects. One can purchase clothing fabrics and haberdashery items from the destocking of prestigious brands. The digital marketplace complements this physical reality. For example, Valentino, the famous Italian brand, offers its fabrics kept in the archives and destined to be no longer used for creative and responsible reuse. All profits from sales will be allocated entirely to Valentino's Bottega dell'Arte, the brand's program aimed at in-house training of professional profiles for the fashion sector. Humana Vintage proposes a different reuse model, combining social sustainability and business retail to support development projects in the Global South through the experience of the eponymous NGO. The chain of stores was born starting from the clothes people donate to Humana. With particular reference to the Italian reality, there are seven Humana Vintage to date. The clothes on display come from the Humana clothing collection in Europe. Indeed, Humana Italia is part of the international federation that coordinates 30 organizations worldwide and has a sales network of 480 charity shops in Europe and the United States. The economic development model offers up to eight collections a year, following seasonality. Humana Vintage sells accessories produced and used in a well-defined period from 1960 to 1990. Since the clothes result from donations, they are often unique pieces. Given that the pool of donations is widespread, the brand has also created Humana Second Hand, where it is instead possible to find garments and accessories from collections that have just passed, including from the Humana clothing collection.

The cases presented in this section discuss how reusing allows for maximizing the lifecycle of fashion products in a circular-driven context that preserves resources through longevity phenomena involving consumers and designers along different stages of the supply chain to keep the materials, garments, and resources invested in their production within the consumption system.

Some issues and criticalities also emerged in this category. The social trends — the speed and uncertainty of trends can limit the companies' ability to take action, as well as the market forces — more competitors that require them to evolve their models to remain competitive — and local forces such as established local physical realities that erode a part of their market and profit.

Conclusions, Limitations, and Future Scope

The paper analyzed how companies in the European fashion industry are carrying out processes of change in their practices incorporating circularity along different stages of the supply chain. The proposed methodology identified the characteristics of innovations and solutions translated into three specific directions for companies' sustainable development and production systems. The defined directions identified a progressive path in the incremental evolution of the adoption of circularity. The results indicate that the relationship between sustainable development and circularity in fashion companies on the European continent has references linked to systemic practices that promote a transformative production model, responding systematically and coherently to incorporate circularity concepts, values, and skills into the processes of the current industrial system. Recycling, remanufacturing, and reuse processes transform linear operations into cyclical ones.

The presented study has some limitations that the author wishes to address. First, the choice of investigating only the European area. This choice was logical, given that the doctoral research that nourished this work has its foundations in this continent. The data that emerged from the literature review, the mapping of the cases, and the interviews all illustrate how the different companies are now developing a high level of awareness about sustainability issues and trying to improve transformational efforts. In this context, the result has been based on the mature European fashion sector that presents existing companies, products, and relatively consolidated customers. It guarantees stability, but companies face several challenges in experimenting with innovations and moving towards circularity. These issues

emerged from the interviews with interviewees discussing how, compared to overseas competitors, there still needs to be a gap in enablers for research, development, and investment. The results should be assumed in this framework.

Further research steps will now focus on analyzing the development of the directions to verify their general validity in the field. Subsequently, it is imagined that pilots with companies will be designed and implemented to test the adoption of these directions in different contexts, such as product sectors, company sizes, or geographical areas. Such pilots should act on the fashion supply chain to transform the current production model — which relies almost exclusively on virgin materials — to decouple economic development from finite resources exploitation. Therefore, new productive chains should be considered. The directions suggest adopting such processes according to a circular ethos. For example, materials and processes related to the Recycling/Sourcing category could affect the use and disposal stages guaranteeing, through their materials characteristics, a harmless impact at their disposal. Companies that operate along the Re-manufacturing/Manufacturing direction could engage in pilots for designing waste out by experimenting with the potential use of the various types of fabric leftovers from their garment manufacturing. Resources in the Reusing/Marketing and Sales category could be envisioned as raw materials for designers to procure in clothing crowd-sourcing activities that can engage local communities.

In conclusion, the article proposes and discusses that circularity implies a significant challenge for the purposes and nature of the fashion industry on the European continent. Through the directions, the author suggests practices, already in use and thus tested, that may point to ideas for support in the development of the model that each company in the industry can begin to implement, ideally as a precursor to more significant changes, and that could help industrial systems design new standard development models towards the goal of sustainability.

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