



Slowing the fast fashion industry: An all-round perspective

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Abstract

The fashion sector contributes significantly to global environmental pollution. Clothing manufacturing and transportation produce a large amount of greenhouse gas emissions. Recent research has shown that nowadays, the number of consumers that are more willing to pay higher prices for clothes with high sustainability content is growing. This paper provides a broad framework of current trends in the fashion, textile, and garment industry, highlighting circular and slow fashion values that companies and policymakers should address in the coming years to maintain their competitiveness in the market and promote sustainable development. The EU Strategy for Sustainable and Circular Textiles is expected to help fashion enterprises achieve more circular, sustainable, and resilient value chains. Notably, encouraging natural and recycled textiles, design for reuse and recycling, second-hand retail and repair, and product-as-a-service models, particularly for items with high turnover rates, have been highlighted as critical factors for reducing the fashion industry's environmental implications.

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Keywords

Circular business model, Circular economy, Recycling, Re-use, Sustainability, Slow fashion.

Introduction

Textiles production and use are increasing, and consequently their influence on climate, water and energy usage, and the environment. In the past two decades,

global textile manufacturing and consumption have nearly doubled [1]. Moreover, the global fashion market is expected to rise from \$1.5 trillion in 2020 to about \$2.25 trillion in 2025 [2,3]. As a result, the demand for fashion is continuously rising, and it is hence not unexpected to consider the fashion industry as one of the major sources of pollution [4]. Instead of assessing how design and manufacturing may accommodate customer wishes and sustainability, clothing is planned and made for rapid trend turnovers through obsolescence and early disposal, allowing for a quick profit and generating a large amount of waste [5]. This business strategy makes the fashion sector one of the most polluting globally, ranking among the top three pressures on water and land usage, as well as one of the top five in terms of raw material use and greenhouse gas emissions [6]. Notably, the fashion industry annually requires 79 billion cubic meters of water (about 20% of the world's total water consumption), generates 1.7 billion tons of CO₂ (almost 10% of the world's total CO₂ emissions), and produces 92 million tons of textile waste [7]. Carbon emissions are creating significant global warming; as a result, natural disasters and effects such as floods, droughts, storms, and sea-level rise are becoming increasingly regular [8].

Furthermore, fashion enterprises frequently outsource the transformation process of raw materials into completed garments to emerging nations, which greatly impacts their social sustainability [9]. As a result, in addition to concerns about carbon emissions, water consumption, and waste disposal, the fashion industry's misuse of personnel working in outsourced production units in nations with cheaper labour costs is a significant issue [10]. Consequently, a clothing company's success should be examined through all three dimensions of sustainability: economic, environmental, and social [10,11]. However, harmonizing these three aspects in extensive and fragmented supply chains necessitates commitment and collaboration from several participants [12–14]. The longer and more complex the chain becomes, the less contact between the various stakeholders exists, for which the monitoring compliance with codes of conduct becomes more complex [15–20].

One of the most challenging issues facing modern civilizations in coping with the environmental and social ramifications of current production and consumption systems is the transition to sustainability [21]. Government regulatory pressures encourage businesses to

make significant changes at the technical, material, organizational, economic, and sociocultural levels [22]. Textiles are identified as a significant product value chain with an urgent need and a great potential for the transition to sustainable and circular production, consumption, and business models in the 2020 Circular Economy Action Plan and the 2021 update of the EU Industrial Strategy [23]. Implementing the circular economy (CE) paradigm in the fashion sector can considerably reduce CO₂ emissions and resource consumption [24,25]. Despite the growing interest in the topic, current research has primarily focused on how prominent fast fashion companies have addressed sustainability challenges, necessitating additional in-depth analysis of the development of the slow fashion business model [26].

This study is a conceptual paper, and its novelty lies in the fact that it aims to shed light on current trends in circular slow fashion businesses, highlighting the main challenges, trends, and opportunities to be exploited in the coming years by all stakeholders. Within this scope, the paper addresses the following research questions (RQs):

- RQ1: What are the current trends and legislative support for fashion industries?
- RQ2: What are the primary characteristics of the circular slow fashion model?
- RQ3: What are the main challenges, trends, and opportunities to be exploited in the coming years by all stakeholders?

The paper is organized as follows: after this Introduction, Section 2 discusses the current trends and legislative support for fashion industries. Section 3 highlights the primary characteristics of the circular slow fashion model. Finally, Section 4 reports the conclusions and implications of the study.

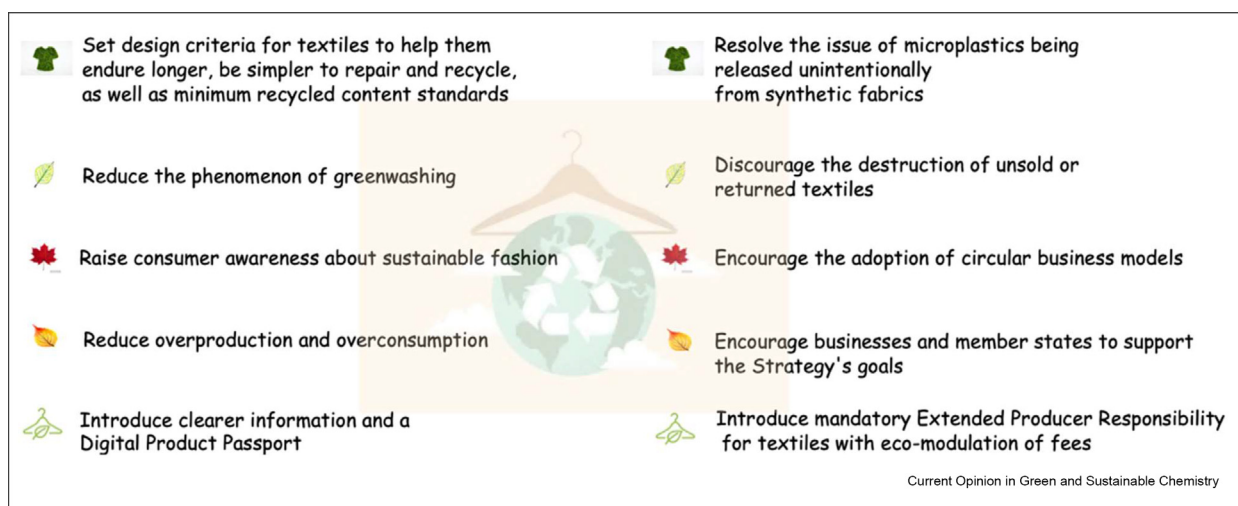
Current trends and legislative support in the fashion, textile, and garment industry

Climate change, environmental degradation, loss of biodiversity, natural resource depletion, and water waste are major issues facing civilisation today [27,28]. The garments produced, purchased, used, and then disposed of in a short time require enormous resources and have an important environmental impact [29]. Most of today's fashion companies adopt a fast fashion business model characterised by speed, novelty, economy, and disposable trends in constant change [30]. Fast fashion is a clothes supply chain model that is intended to adapt rapidly to the newest clothing styles by often changing the products offered in retailers [31]. This is possible by the lean and just-in-time approaches, and production is very often located in countries with low-cost labour. Fast fashion regularly introduces new products to buy: from

2000 to 2011, the average number of collections produced by European garment firms per year increased from two to five, with Zara, for example, releasing 24 new clothing collections every year and H&M between 12 and 16 [7]. As a result, consumers increasingly see low-cost apparel as perishable commodities that are "almost disposable", increasing the purchase impulse and the consequent generation of waste. In this context, Generation Y, the largest consumer group of fast-fashion items, is predicted to worsen the problem because of their reluctance to dispose of their clothing sustainably [32]. Indeed, while Generation Y's customers are believed to be aware of the many environmental issues facing society, their attitudes/intentions do not always convert into action, notably in the fashion domain [33].

Furthermore, due to outsourcing production in under-developed nations, fashion companies take advantage of a significant absence of strict legislation and procedures governing worker safety and health protection [9]. The collapse of the Rana Plaza Factory Complex in Dhaka, Bangladesh, in 2013 was a terrible and sad metaphor for fast fashion's uncontrollable impacts [34,35]. Following the echo of this public indignation, many companies have begun to invest in more virtuous production practices to safeguard their reputation than for ethical discourse [36]. However, legislative support is also fundamental to achieving more sustainable production and consumption systems in the fashion and textile industries. Europe will be the first area in the world to act against fast fashion and its blighting waste issue. After food, housing, and transportation, textile consumption has the fourth-highest effect on the environment and climate change in Europe [6]. Furthermore, the textile and garment industries employ about 1.5 million people in Europe, and it is an important source of local employment and business prospects [6]. The importance of ensuring fair working conditions and environmental protection in both the global value chains of new items imported into the EU and the downstream value chains of exported used textiles are being well recognised among stakeholders. As a result, the EU Strategy for Sustainable and Circular Textiles development was presented last March 31st, 2022 [37,38]. The Commission is advancing a transition pathway to help the textile ecosystem make the switch to a greener, more circular and resilient, and digital economy, as well as to provide customers with more sustainable options. Notably, Figure 1 synthesizes the key aspects of the Strategy. In the next years, the approach will be followed by a series of legislative measures and other activities, including product design guidelines, labelling, outlawing the destruction of items, and stricter supply chain accountability requirements. Moreover, the EU Strategy considers the Extended Producer Responsibility (EPR) as an essential instrument for promoting more sustainable goods on the market and more sustainable management of post-

Figure 1



Key points of the EU Textiles Strategy.

consumer textiles. The EPR holds manufacturers and importers legally responsible for ensuring that worn clothing is reused or recycled [39]. As a result, the new legislation might boost growing trends like garment exchanges and the usage of smartphone applications like Vinted, allowing the purchase, sale, and exchange of new or second-hand items. The objective of the EU Strategy is that, by 2030, textile goods sold in the EU will be long-lasting and recyclable, composed chiefly of recycled fibres, devoid of harmful compounds, and manufactured following social and environmental standards [23]. Consumers are becoming more conscious of the ethical concerns surrounding the clothes they buy [40,41], and they will benefit from longer high-quality and low-cost textiles. Fast fashion is no longer fashionable; nowadays, re-use and repair services are widely accessible [1]. In a competitive, resilient, and inventive textiles industry, producers assume responsibility for their goods along the value chain, even when they become waste. The circular textiles ecosystem will prosper, thanks to ample capacity for innovative fibre-to-fibre recycling and reducing textile incineration and landfilling. The EU Strategy's objectives can be achieved also thanks to the digital product passport. This tool leverages blockchain technology to carry out the inventory of all raw materials and components employed in the product, as well as their origin. As a result, the new digital technologies could allow fashion businesses to achieve a sustained competitive advantage and sustainable production and consumption. Particularly in the fashion industry, transparency is essential for attaining accountability, reducing environmental impact, and ensuring that employees' rights are respected. Blockchain-enabled capabilities offer

opportunities to enhance improved information transparency between the organization and its stakeholders [42].

Towards a circular slow fashion model-society

Slow fashion has emerged as an effective way to improve sustainability in the fashion industry, representing an alternative to the dominant fast fashion model [43]. Circular economy and the slow fashion movement have revealed that the industry cannot continue operating with existing methods that threaten the world's finite resources [43]. Nowadays, there is a need for stimulating and encouraging circular slow fashion business models, including reuse, redistribution, second-hand retail and repair, and product-as-a-service models [44]. Circular fashion aims to minimize waste and retain materials as feasible as close to the consumption and manufacturing cycle. To make this feasible, textiles and clothes should be designed with the circular economy in mind from the beginning [45]. They must be more robust to last several life cycles and include recyclable materials adapted to the intended purpose [7]. Reverse logistics, i.e. organizing the return of used items from customers, is required for the wide-scale implementation of these business models. Clothing firms might set up collection systems for discarded garments so that they can be reused (sold as used items or donated to Caritas) or recycled, with the customer receiving a modest compensation for each used garment returned. Businesses and trade groups have backed the adoption of models of high-quality, long-lasting items with high personal worth, as well as repair and fitting services, B2B leasing/rental, and the redesign of old products [7]. An

example could be the rental of clothes for weddings and special occasions; therefore, clothes that, if purchased, once used would be thrown away or, in any case, no longer worn and destined to become waste. As a result, the slow fashion movement identifies a production philosophy that is attentive to the respective needs of the various stakeholders, designers, buyers, retailers and consumers, and the impact that fashion production has on workers, consumers, and ecosystems [46]. Notably, slow fashion ensures the reduction of resource consumption, including water and energy, and encourages the production of quality and value in contrast with disposable fashion. In practice, slow consumers will buy fewer products but of greater value [43]. Slow fashion encourages different and innovative business models, small local firms, artisanal and vintage productions, recycling, reuse, second-hand, and waste reduction. Extending the life of textile items is one of the most efficient slow fashion strategies to reduce garments' climatic and environmental impact significantly [47]. Colourfastness, rip strength, and the quality of zippers and seams are the most common reasons customers discard textiles. Increased durability would allow customers to use garments for long periods while also supporting circular business models, including reuse, rental and repair, take-back services, and second-hand shopping [48]. Stakeholders are largely in favour of fostering circularity for textiles, stating that the EU Strategy should strive to maintain textile goods in the economy for as long as feasible by encouraging improved product quality, durability, reuse, and repair [37]. Furthermore, while sophisticated sorting and recycling technologies must be improved [49], better product design is the first step in addressing technical issues [50]. For example, fibres are often combined with others (e.g. polyester with cotton), making recycling more challenging. Therefore, to produce clothes, slow fashion businesses use materials that can be recycled without the need to separate them, and product design plays a critical part in achieving this objective. An example is the use of hemp buttons, which can be recycled together with the rest of the garment.

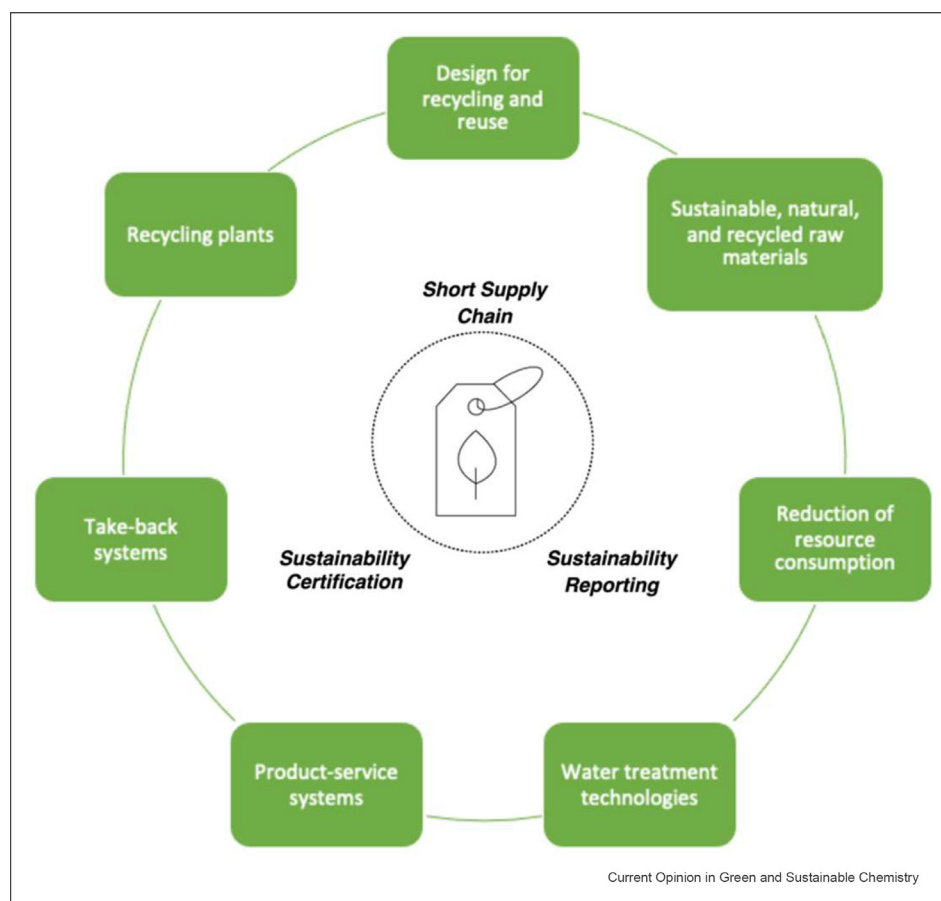
Furthermore, the circular slow fashion business model is characterised by the use of sustainable, natural, and recycled raw materials. Organic cotton, for example, has a lower environmental impact than conventional cotton since it requires limited water and pollutes less [7]. Some industries are experimenting with innovative techniques, such as using CO₂ instead of water as a dyeing medium. Indeed, reducing water consumption is a significant objective of the fashion industry. Further, the dyeing process contributes between 15 and 20% of the total wastewater flow, releasing various toxic substances into the rivers, such as sulfur, nitrates, soaps, and chromium, as well as compounds and heavy metals including arsenic, lead, cadmium, mercury, nickel, and cobalt. As a result, installing water treatment and recycling plants

could solve this problem [51], as well as using natural colours with minimal environmental implications [52]. The air gap membrane distillation (AGMD) is a flexible water treatment method that can potentially improve textile dyeing wastewater treatment [53]. Fashion companies are obtaining various sustainability accreditations to certify their commitment to corporate social responsibility. An example is the GOTS certification, attesting the use of natural fibres in organic textile products, coming from crops treated with reduced water consumption and non-toxic products for humans. Another fundamental accreditation for the fashion industry is the Fair-Trade certification, attesting compliance with workplace safety conditions and hygiene standards of agricultural producers in developing countries, allowing consumers to make more responsible choices regarding the products they purchase. Additionally, the fashion industry is experimenting with biobased polyester (also known as biosynthetic), which is made from renewable resources. Lyocell (also known as Tencel, made of eucalyptus cellulose that grows quickly and requires no irrigation or pesticides), Bemberg (also known as Cupro, made of cotton waste that cannot be spun into thread), and Piatex (made of pineapple leaves) are some of the other innovative and sustainable materials that the fashion industry is experimenting [54]. In addition, through sustainability reporting activities, fashion companies voluntarily communicate the results of their business periodically, not limited to discussing financial and accounting aspects but also reporting on the social and environmental results generated. Fashion companies employ this tool because it produces a double set of benefits, i.e. internal benefits that are reflected in better organization and management of processes within the company and external benefits that result in better visibility and reliability for external stakeholders [55]. As a result, the sustainability report can strengthen trust among internal and external stakeholders, increasing consumer awareness of sustainable fashion. Figure 2 synthesizes the concepts mentioned above, thus providing a theoretical framework of the circular slow fashion model, ranging from design and production to reverse logistics processes. Particularly, sustainability reporting and certifications, as well as the short supply chain, help strengthen the model and create lasting relationships with stakeholders.

Discussions and conclusions

The current fashion industry has been acknowledged as unsustainable both from environmental and social perspectives. Slow fashion has emerged as a viable alternative to the prevalent fast fashion paradigm, reducing the overall environmental implications of the value chain. The slow fashion business model is based on CE principles, low consumption, fair trade, and sharing economy [56]. However, in order to stimulate the

Figure 2



Circular slow fashion model.

development of this new kind of business model and achieve sustainable production and consumption, legislative support is fundamental. As a result, the European Commission has developed the EU Strategy for Sustainable and Circular Textiles to establish conditions and incentives to achieve a sustainable and circular ecosystem in the fashion industry by 2030, thus supporting enterprises adopting slow fashion values. The EU Strategy highlights initiatives to boost circularity and sustainability, promote sustainable lifestyles, decrease waste creation, and encourage the efficient use of material throughout the textile value chain. However, government support is also essential for Asian developing countries, where inadequate laws and regulations have contributed to several environmental and social problems [57]. Further, different studies in the literature have shown a gap between the attitude and sustainable behaviour of Generation Y [32,33], which is more focused on innovative economic models (e.g. on-demand services) rather than CE ones [58]. However, the change to a circular economy strategy in the textile and apparel industries goes in parallel with increased

consumer knowledge of the social and environmental consequences of their decisions, resulting in a trend toward responsible consumption of sustainable textiles. By educating customers about sustainability challenges in the fashion industry, individuals in young generations, i.e. Generation Z, may significantly influence consumer behaviour, pushing them to purchase second-hand and bio-based clothes [59] manufactured using fibers derived from renewable resources like starches and lipids obtained from maize, sugar cane, beet, or vegetable oils. Consumers may benefit from buying second-hand clothing in several ways, not the least because the price is generally better, especially for pricey and recognizable brands [59]. As a result, Generation Z is increasingly supporting a sustainable/circular economic paradigm to combat climate change by adopting responsible consumerism [58]. In this context, calculating the circular premium, or the difference between the circular pricing for an item (i.e., the price associated with a 100% biodegradable, completely recycled, or entirely repurposed product) and the standard market price is crucial (i.e. the price associated with a product

made from fossil fuels) [59]. Despite these advances, there is still a bias in the fashion industry, where people seem to be mainly aware of environmental issues related to clothing production, neglecting the social and economic implications of the industry [59]. This bias must be overcome to bring together the three dimensions of sustainability in a single comprehensive framework.

Practical implications

This study revealed that apparel managers should prioritize sustainability reporting in order to successfully convey corporate values to customers and invest in digital technologies, including blockchain, to maintain supply chain transparency. In addition, we identified circular business models, sustainable and circular practices, and technical advances to provide a comprehensive framework for fashion firms looking to interface with sustainability and circular economy dimensions. As a result, this article could serve as a guideline for developing countries' governments to promote sustainable initiatives and raise consumer awareness. Some initiatives could include adopting a short supply chain and a national occupational health and safety policy, implementing safety inspection standards, and reducing the consumption of valuable resources, such as water, during production processes. In addition, policymakers should promote awareness campaigns to inform consumers not only about the environmental impact of clothing production but also about the social and economic implications of the industry, overcoming the sustainability bias [59].

Limitations and future research directions

This paper primarily investigated sustainable fashion within the EU context. Thus, future research could expand the analysis to other countries to highlight similarities and differences. In addition, given the qualitative/exploratory nature of the study, we could not investigate causality between circular and slow fashion initiatives and sustainability performance. As a result, future studies could conduct quantitative analyses to validate the findings of this research. Furthermore, by conducting a long-term longitudinal study, the influence of the EU Strategy on the transition from the fast to the slow fashion business model may be investigated. Finally, an additional future research stream concerns examining the implications of new digital technologies, such as the blockchain, on the decision-making process of fashion businesses and consumer purchasing choices. Managing product traceability through blockchain means providing customers with a record of the garment's journey, from raw materials to all the processing performed. In this way, the brand and the consumer can immediately verify its authenticity and the sustainability of the process.

Conflict of interest statement

Nothing declared.

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This study focuses on understanding how the fashion system driven by change, speed, aesthetic fads, and product obsolescence can be repositioned and challenged to motivate greater sustainability.

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This research explores how sustainable product attributes (i.e., recycled materials) affect the consumers' purchase intention of luxury and fast fashion products.

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This article reviews the literature on environmentally sustainable practices in the textile, apparel and fashion (TAF) industries to map the practices across various manufacturing processes and develop a conceptual framework to guide an investigation, from an environmental perspective, from an environmental perspective of sustainable practices in the TAF industries.

42. Benstead AV, Mwesumio D, Moradlou H, Boffelli e A: **Entering the world behind the clothes that we wear: practical applications of blockchain technology.** *Prod Plann Control* 2022: 1–18. <https://doi.org/10.1080/09537287.2022.2063173>. mag.

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The authors empirically teste a structural model that considers the slow fashion attributes that contribute to creating perceived customer value, which subsequently increases a consumer's intention to buy and pay a price premium for slow fashion products.

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45. To MH, Uisan K, Ok YS, Pleissner D, Lin e CS K: **Recent trends in green and sustainable chemistry: rethinking textile waste in a circular economy.** *Current Opinion in Green and Sustainable Chemistry* 2019, **20**:1–10. <https://doi.org/10.1016/j.cogsc.2019.06.002>. dic.

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49. Marques AD, Marques A, Ferreira e F: **Homo Sustentabilis: circular economy and new business models in fashion industry.** *SN Appl Sci* 2020, **2**. <https://doi.org/10.1007/s42452-020-2094-8>. feb.

The authors describe the awareness of the fashion industry, in general, on the over-consumption that the business practices of this industry have generated.

50. Franco MA: **Circular economy at the micro level: a dynamic view of incumbents' struggles and challenges in the textile industry.** *J Clean Prod* 2017, **168**:833–845. <https://doi.org/10.1016/j.jclepro.2017.09.056>. dic.

The main contribution of this paper is the provision of a dynamic understanding of how certain collaborative supplier-buyer factors of innovation (i.e. power balance, supply chain position and a shared

vision) coupled with complex aspects in product design (e.g. basic materials, architecture, and functionality), are put together to define the output speed and quantity of circular products to be sold, taken back, and ultimately regenerated.

51. Zhen H, *et al.*: **Assessing the impact of wastewater treatment plant effluent on downstream drinking water-source quality using a zebrafish (*Danio Rerio*) liver cell-based metabolomics approach.** *Water Res* 2018, **145**:198–209. <https://doi.org/10.1016/j.watres.2018.08.028>. nov.

The authors use cell-based metabolomics in the context of a fashion proof-of-concept to explore the biological effects of contaminants when they travel from a wastewater treatment plant (WWTP) discharge to a drinking water treatment plant (DWTP) intake.

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53. Leaper S, Abdel-Karim A, Gad-Allah TA, Gorgojo e P: **Air-gap membrane distillation as a one-step process for textile wastewater treatment.** *Chem Eng J* 2019, **360**:1330–1340. <https://doi.org/10.1016/j.cej.2018.10.209>. mar.

The authors employ commercial polytetrafluoroethylene (PTFE) membranes in air gap membrane distillation to recover pure water from simulated textile wastewater containing NaCl and either sunset yellow (SY) or rose bengal (RB) dyes and sodium dodecyle sulfate (SDS) surfactant.

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This paper provides an examination and guiding process for developers by scaling up results from recent laboratory work to a small-scale industrial facility.

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The research presented in this paper identifies disclosure strategies to achieving transparency in sustainability reporting with the aim of supporting strategic thinking around transparency in the fashion industry.

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This paper discusses the potential of sustainable chemistry as a possible solution to the textile industry in the developing world.

58. D'Adamo I, Lupi G, Morone P, Settembre-Blundo D: **Towards the circular economy in the fashion industry: the second-hand market as a best practice of sustainable responsibility for businesses and consumers.** *Environ Sci Pollut Control Ser* 2022, **29**:46620–46633. <https://doi.org/10.1007/s11356-022-19255-2>.

This paper employs the analytic hierarchy process to demonstrate that garment collection and recycling are not necessarily best practices for the circular economy.

59. Colasante A, D'Adamo I: **The circular economy and bio-economy in the fashion sector: Emergence of a “sustainability bias.”** *J Clean Prod* 2021, **329**, 129774. <https://doi.org/10.1016/j.jclepro.2021.129774>. art.

This paper investigates consumer attitudes towards the fashion sector, particularly with respect to the bioeconomy and the circular economy.